KENWOOD

INSTRUCTION MANUAL

HF TRANSCEIVER

Model TS-940S

NOTES:

1. If the timer switch is set to ON, the unit sometimes does not function even when the POWER switch is set to ON.
2. When the squelch is not in use, turn the SQL control fully counterclockwise. If the control is turned fully clockwise, the reception sound sometimes cannot be heard.

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■ UNPACKING

Remove the TS-940S from its shipping container and packing material and examine it for visible damage. If the equipment has been damaged in shipment, notify the transportation company immediately. Save the boxes and packing material for future shipping.

The following accessories should be included with the transceiver.

1. Instruction Manual (B50-8001-10) 1
2. 13-pin DIN plug (E07-1351-05) 1
3. 7 pin DIN plug (E07-0751-05) 1
4. Fuse (6A) (F05-6021-05) or
   (4A) (F05-4022-05) 1
5. Power cable 1
6. Warranty card (USA only) 1

■ OPERATING PRECAUTIONS: READ BEFORE OPERATING

Read this instruction manual carefully before attempting operation of your new TS-940S. While this set is similar to others you may have owned before, there are many features that are new or unique to this radio. Familiarize yourself with the operation of controls and procedures before you even apply power. Note that the final power transistors might be damaged during transmission if the transceiver is operated into an improper load.

1. If the built-in antenna tuner is used, operate at full power only after automatic tuning is completed.
2. Use only a resonant 50 ohm antenna which has been adjusted for an SWR of 1.5 to 1 or less.
3. DO NOT transmit without an Antenna or 50 ohm load.

THE FOLLOWING DEFINITIONS APPLY IN THIS MANUAL:

NOTE: If disregarded, inconvenience only – no damage or personal injury.

CAUTION: Equipment damage may occur, but not personal injury.

■ FEATURES

Circuit Configuration providing Receiver Performance of the Highest Quality.

1. Trio-Kenwood has succeeded in achieving the highest level dynamic range of 102 dB (with an IF bandwidth of 500 Hz.)
2. General coverage receiver section tunes from 150 kHz – 30 MHz.
3. The transceiver can operate in any mode (SSB, CW, AM, FM or FSK).
4. Every possible function has been adopted to eliminate radio interference.

- SSB slope tune
- CW VBT
- Notch (100 kHz IF notch)
- AF tune
- Variable CW pitch circuit
- Dual Noise Blankers
- 10 Hz Step RIT/XIT with a ±9.99 kHz tuning range employing an optical encoder
- Four step RF ATT control prevents saturation upon reception of excessive signal inputs.

Transmitter Section with Low Distortion and High Reliability

1. The power supply voltage of 28V has been adopted to assure the lowest distortion.
2. Semi break-in or full break-in.
3. Auto tuner available built in or as an optional accessory.
4. Built-in RF speech processor.

Microprocessor Control of various Digital functions

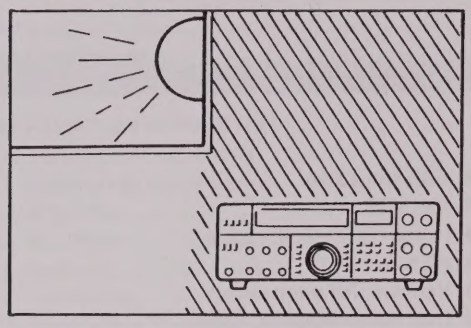
1. VFO with auto quick tuning function
2. Built-in Dual digital VFO's
3. Direct entry of frequency from the key board.
4. 40-Channel Memory
5. Two types of frequency scan
   Program scan
   Memory scan

Design and Construction Appropriate to a Quality Transceiver

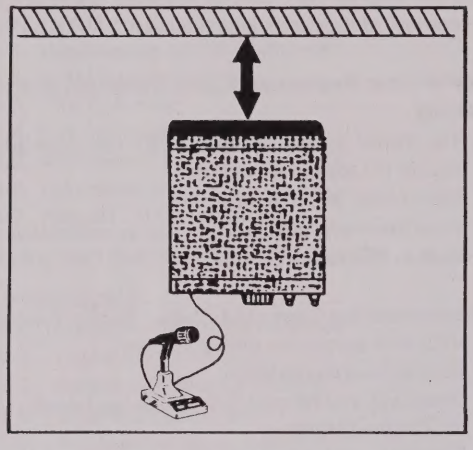
1. Dual displays
   - Main display is a large, two color fluorescent display.
   - Sub-display consists of a 2-line, 16 digit liquid crystal dot matrix.
2. Built-in 24 hour digital clock with timer
3. All-in-one type construction containing all components from AC power supply to speaker

1. PREPARATION BEFORE USE

1-1. INSTALLATION PRECAUTIONS



Choose an operating location that is dry and cool, and avoid operating the transceiver in direct sunlight.



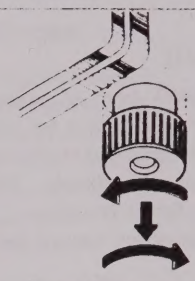
Allow at least 3 inches clearance between the back of the equipment to any object. This space allows an adequate airflow from the ventilating fans to keep the transceiver cool.

1-2. COOLING FAN OPERATION

The cooling fan operates automatically when the heat sink temperature rises, and stops when the temperature falls.
The heat sink is die-cast aluminum integral with the rear panel for sufficient heat dissipation. Therefore, the cooling fan will rarely operate during ordinary operation.
If the cooling fan operates, insure adequate ventilation to insure good heat dissipation.

1-3. FRONT FEET

By extending the front feet, the front panel can be elevated for operating convenience.
Turn the front feet left and pull down.
Then turn right to lock.

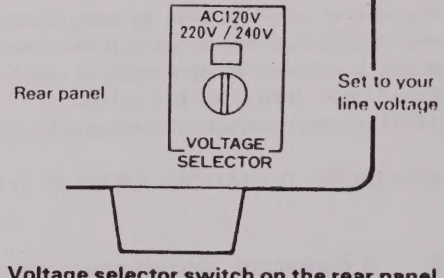


Front feet extension

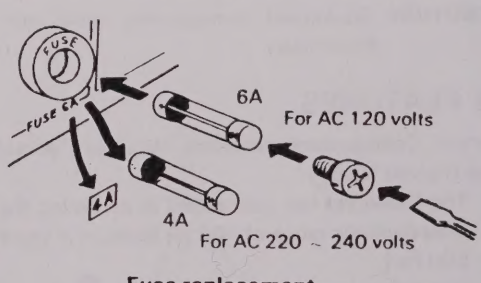
1-4. AC POWER

The TS-940S is supplied to operate from a 120V AC, 220V AC or 240V AC 50/60 Hz power source capable of supplying 510 watts or more.

For units shipped to the U.S.A., the switch is set for 120 VAC with a 6-ampere fuse installed.
For units shipped to European, Central, South American, and African countries, the switch is set for 220 VAC with a 4-ampere fuse installed.
For units shipped to Oceania countries, and U.K. the switch is set for 240 VAC with a 4-ampere fuse installed.



Voltage selector switch on the rear panel



Fuse replacement

3. OPERATION 1

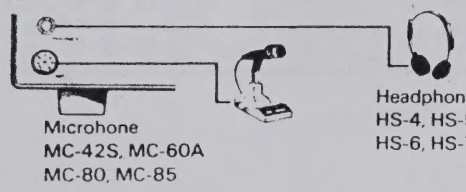
3-1. HEADPHONES AND MICROPHONES

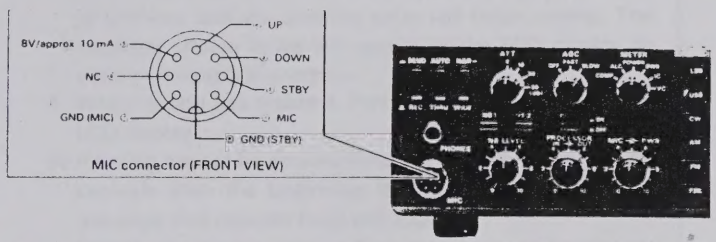
Headphones

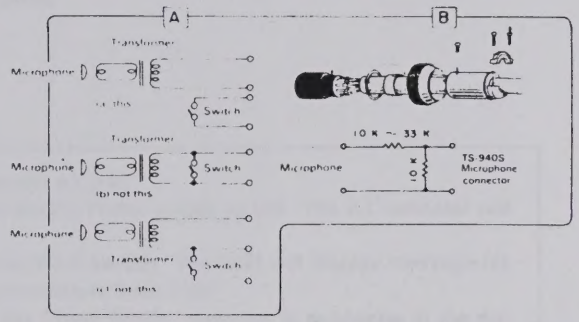
The Trio-Kenwood headphones HS-4, HS-5, HS-6 and HS-7 can be used with this transceiver. When using other headphones, use 4 to 16 ohms impedance. Stereo headphones can also be used.

Microphones

The Trio-Kenwood microphones MC-42S (handheld), MC-60A, MC-80, MC-85 (table-top type) are recommended.







Either a low or high impedance microphone (500 Ω ~ 50 kΩ) may be used. The PTT switch must be isolated from the microphone audio circuit, as shown in [A]. Use a microphone with a separate switch and MIC line so both PTT and VOX may be selected. Figure [B] shows the circuit that should be used for high output microphones such as the Shure 444, and the D-104.

3-2. INITIAL SETTING CONFIRMATION

Prior to operation ensure the following switches and controls are set as indicated in the figure below:

[1] Ensure the POWER switch is OFF.

[2] An antenna must be connected.

Caution:
Never transmit without the antenna connected.

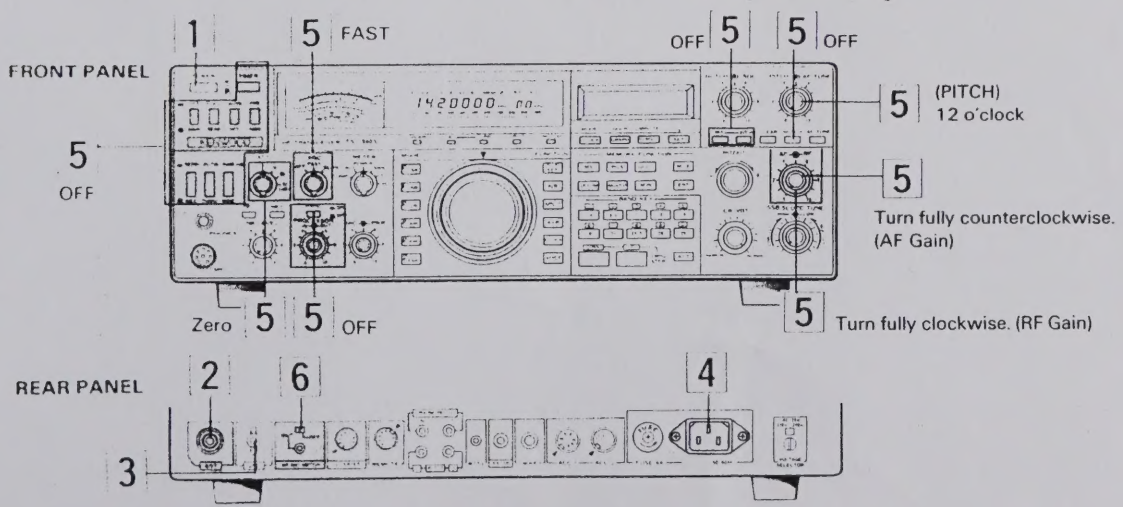
Note:
Ensure the VOLTAGE SELECTOR switch is set for your AC line voltage.

[3] A ground must be connected.

[4] The power cord is connected.

[5] Ensure the front panel controls and switches are set as shown in the figures below.

[6] The RX ANT switch is OFF.

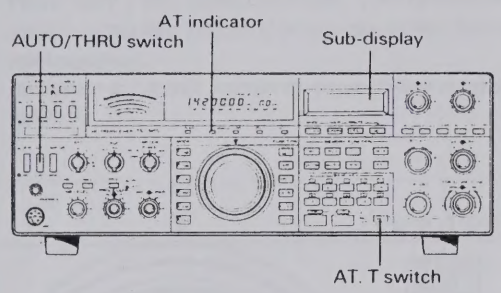


4. AUTO ANTENNA TUNER OPERATION

If the TS-940S is operated into an antenna with a high SWR, the final stage SWR protection circuit may operate (when SWR is greater than approximately 2 : 1). Use of the AT-940 Automatic Antenna Tuner will help you to match the antenna to the transceiver. The AT-940 is capable of matching a 20 – 150 ohm load, or approximately a 3 : 1 SWR. If the antenna and feed line exceed this range the tuner may not be able to find the correct match. If the tuner cannot match after two attemps, check your antenna and feed lines.

Output power of the TS-940S will automatically be set to approximately 50 watts during the tuning process to protect the finals against damage.

While the automatic antenna tuner is capable of reducing the apparent SWR of the antenna system, it is important to remember that maximum power output will only occur when the antenna has been adjusted for the lowest possible SWR.



(a)

ANTENNA TUNER AUTO TUNE READY

(b)

ANTENNA TUNER TUNING ···· !!

(c)

TUNING FINISHED TX – READY

(d)

ANTENNA TUNER NO MATCH

To operate the AT-940:

1. Set the AUTO/THRU switch to ON. The AT indicator will light.
2. Press the AT.T switch. The LCD will display message (a), for approximately 3 seconds.
3. While the "Tune Ready" message is appearing in the display, initiate transmit with the PTT switch, SEND switch, or CW key, and the antenna tuner will begin tuning. The message shown in (b) will appear in the LCD display to confirm tuning is in progress.
4. When tuning has finished, message (c) will appear in the LCD display.
5) If tuning cannot be accomplished within approximately 30 seconds after the beginning of the tuning process, the message that appears in (d) will appear.
   Switch to receive, wait a few moments, and then try again. If no match can again be found, check your antenna feedline, and antenna system

Note:

When adjusting an external antenna tuner, reduce the output power of the TS-940S to approximately 50 watts. This will provide adequate protection for the final amplifiers during tuning.

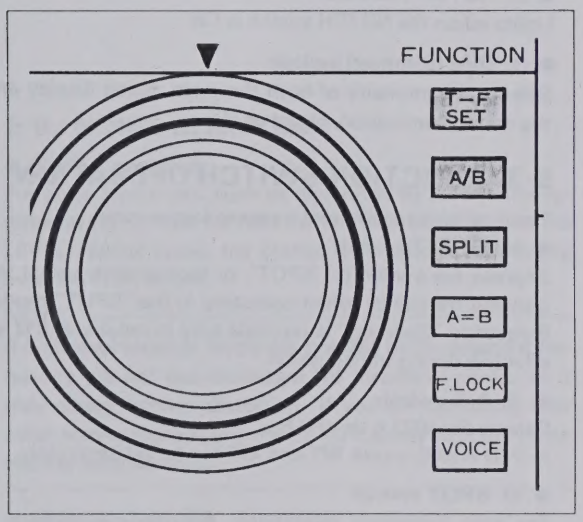
5-4. DUAL VFO OPERATION

The TS-940S has two VFO's, A and B, which are controlled by the microprocessor. The Main Display and Sub-display provide complete operating information for these VFO's. The active VFO is shown in red on the Main display, and on the Sub-display (See Section 7-3).
To change the active VFO press the A/B switch.

5-5. T-F SET SWITCH

To operate SPLIT frequency (different transmit and receive frequency):

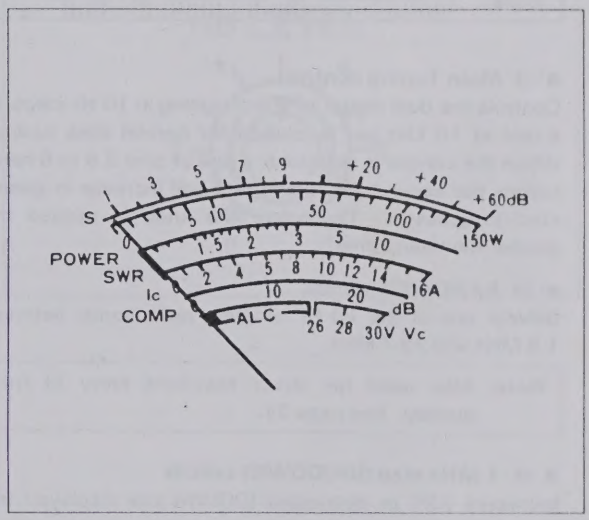
1. Enter the desired receive frequency into the Active VFO.
2. Press the SPLIT key. The SPLIT indicator will light.
3. Press the T-F SET switch and hold. The transceiver will switch to the idle VFO so that you can select the transmit frequency.
4. Release the T-F SET switch to return to the receive frequency.



5-6. METER

Provides seven different functions, depending on the METER switch setting. In receive the meter is automatically an S-meter, and shows the received signal strength on a scale of 0 to 60 dB over S9. In transmit, the meter function depends on the position of the METER switch. This is an average responding meter, NOT a peak-reading meter.

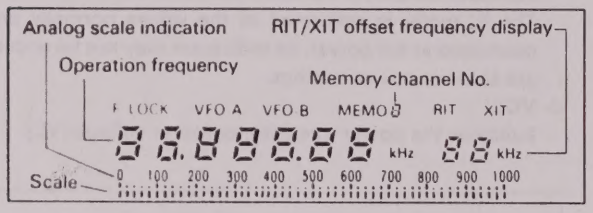
- ⑩ **METER switch** Ⓣ
- ○ **COMP** – Indicates compression level during speech processor operations. Do not exceed 10 dB of compression.
- ○ **ALC (Automatic Level Control)** – Indicates internal ALC voltage, or the ALC voltage fed back from a linear amplifier connected to this transceiver.
- ○ **POWER**:
  Indicates transmitter RF output power.
- ○ **SWR**:
  Indicates voltage standing wave ratio (VSWR).
- ○ **IC**:
  Indicates the power transistor collector current (IC).
  The IC meter is calibrated at the values normally encountered at full power, its indication may not be accurate at lower power settings.
- ○ **VC**:
  Indicates the power transistor collector voltage (VC).



5. OPERATION 2

5-1. FREQUENCY AND BAND SELECTION

● ⑪ **Main display**
Displays the operating frequency to the nearest 100 or 10 Hz depending upon the setting of the DISPLAY resolution switch on the top control panel. RIT frequency is displayed up to ± 9.99 kHz.
The DISPLAY switch on the top panel allows you to select the desired resolution. The analog scale display will normally indicate the relative band position through a 1 MHz range, in 20 kHz steps. The step size and tuning range may be changed to 2 kHz steps in a 100 kHz range thru use of the SCALE switch.



● 57 **Main Tuning control**
Controls the dual digital VFO's operating in 10 Hz steps, at a rate of 10 kHz per revolution for normal slow tuning. When the control is rotated at a rate of over 5.5 to 6 revolutions per second the tuning rate will increase in geometric progression. The faster the knob is rotated the greater the tuning step.

● 68 **BAND/KEY switch**
Selects one of the 10 HF amateur radio bands between 1.8 MHz and 29.7 MHz.

> **Note:** Also used for direct keyboard entry of frequency. See page 34.

● 65 **1 MHz step (UP/DOWN) switch**
Increases (UP) or decreases (DOWN) the displayed frequency in 1 MHz steps, throughout the entire frequency range of the transceiver. Pressing and holding either switch will cause the frequency to continuoslly step up or down as long as the switch is held depressed.

5-2. INDICATORS

● 12 **F. LOCK indicator**
Lights up when the F. LOCK switch is pressed.

● 14 **VFO A indicator**
Lights up during VFO A operation.

● 16 **VFO B indicator**
Lights up during VFO B operation.

● 18 **MEMO (Memory) channel idicator**
Shows memory channel operation and lights up when setting the VFO/M switch 64 to MEMO.

● 20 **RIT indicator Ⓡ**
Lights up when turning on the RIT switch 32.

● 21 **XIT indicator Ⓡ**
Lights up when the XIT switch is ON.

● 13 **ON AIR indicator Ⓣ**
Lights during transmit.

● 15, 17 **ANT TUNE (Antenna Tuner) indicator Ⓣ**
Lights to show the automatic antenna tuner is in operation.
When lit, do not operate further until it goes off.

● 22 **NOTCH indicator**
Lights when the NOTCH switch is ON.

● 6 **DIM (Dimmer) switch**
Selects the intensity of both the main digital display and the meter illumination, bright or dim.

5-3. FUNCTION SWITCH OPERATION

These selects receive and transmit frequencies.

● 58 **T-F SET switch**
Depress the switch to "SPOT", or momentarily select the transmit frequency when operating in the "SPLIT" mode. Frequency "Spotting" is possible only in receive and is ineffective during transmission.

● 59 **A/B switch**
Selects the VFO A or VFO B.
In VFO A or B, mode, RIT and XIT can be set seperately.

● 63 **SPLIT switch**
For split frequency operations; A-R, B-T (A receive, B transmit), or B-R, A-T.
When the switch is on, the SPLIT indicator lights.

● 62 **A = B switch**
Used to equalize the frequency of the idle VFO with that of the active VFO. RIT, XIT and mode are also equalized.

● 61 **F. LOCK switch**
Used to lock the frequency of the VFO. In this state, the frequency cannot be varied with the main tuning control or band switches. However, RIT and XIT still function.
The F. LOCK indicator lights.

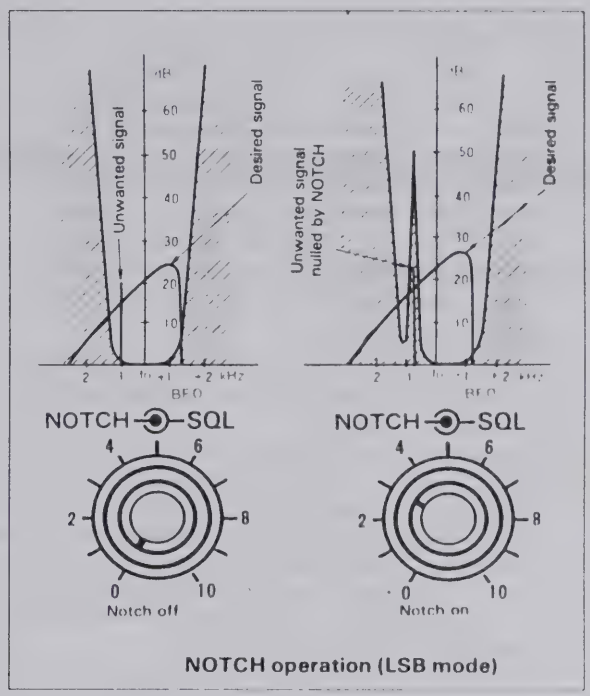
● 60 **VOICE switch**
When the optional VS-1 voice unit is installed the operating frequency will be announced whenever the VOICE switch is pressed.
For a dial frequency of 14.200.00 the frequency will be announced as: "One", "four", "point", "two", "zero", "zero", "zero", "zero".

Note:

If the voice synthesizer (VS-1 installed) is not activated even when the VOICE switch is operated, turn the POWER switch OFF and turn it ON again to release the locked state.

● ㉞ **NOTCH control**

Use this control when you are experiencing interference from a CW Heterodyne type signal. Turn the NOTCH ON and slowly adjust the NOTCH control to minimize the beat signal. A beat of approximately 1.5 kHz can be reduced at the approximate center position of the control. Please note that this control will not eliminate SSB, AM or FM type interference. The bandwidth of such signals is approximately 3 – 6 kHz wide. When in the USB, CW or AM mode a beat tone lower than the center frequency can be reduced by rotating the control clockwise from the center point. In LSB or FSK mode adjust the control counter-clockwise.



NOTCH operation (LSB mode)

5-8. NOISE BLANKER

● ㊽ **NB 1 switch** Ⓡ

For pulse type noise, such as generated by automotive ignition systems, turn the NB1 switch ON. Adjusting the NB LEVEL control varies the blanker's threshold, eliminating even low level noises.

NOTE:

If high level receiver levels are present on an adjacent frequency, do not use excessive NB threshold LEVEL as it may cause receiver distortion. If you are operating near other strong signals, use the RF ATT along with the noise blanker level control.

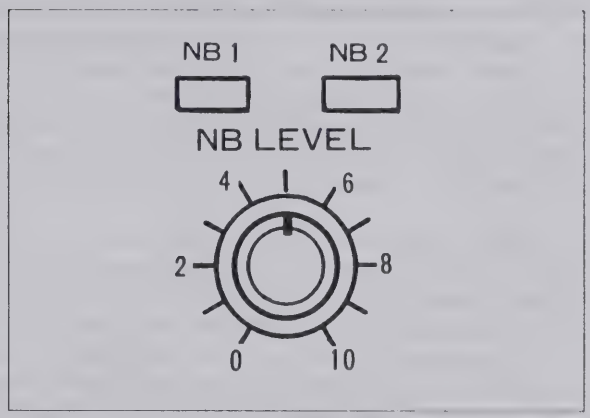
● ㊿ **NB2 switch** Ⓡ

Noise blanker 2 is used for long duration pulse noise, like the "Russian Woodpecker".

Unfortunately no noise blanker can remove all different types of interference, but the two noise blankers that have been provided in the TS-940S are effective in most cases.

● ㊾ **NB LEVEL control** Ⓡ

Controls the noise blanker operating level. Use only the minimum level necessary.



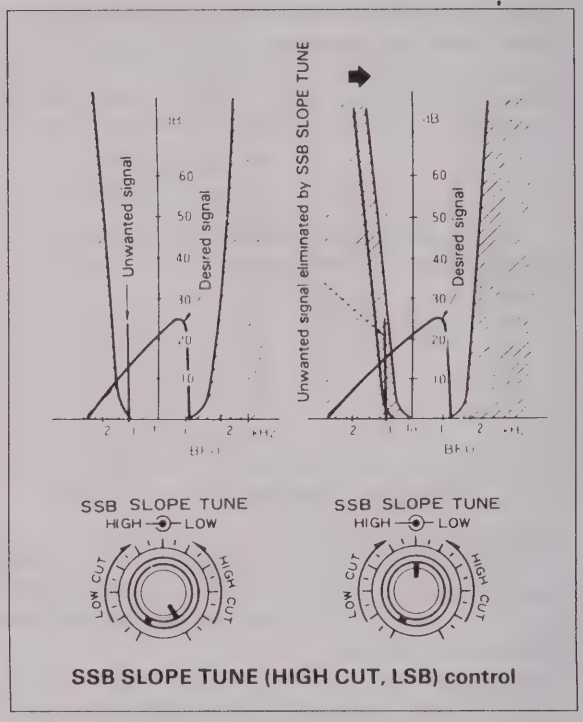
5-7. INTERFERENCE REDUCTION CAPABILITY

SSB SLOPE TUNE control

During SSB reception, these controls permit you to reduce the apparent IF filter bandwidth and therefore reduce adjacent channel interference.

- **SSB SLOPE TUNE HIGH CUT control:**
  Adjust the HIGH CUT control counterclockwise, and interference from signals higher than the operating frequency will be reduced. The high-frequency components of the resulting receiver audio will also be reduced. The GRAPH function of the Sub display will graphically show the approximate change in IF passband.
- **SSB SLOPE TUNE LOW CUT control:**
  Adjust the LOW CUT control clockwise, and interference from signals lower than the operating frequency will be reduced. As with the HIGH CUT control, use of the LOW CUT control will also affect the audio frequency passband. In this case the low frequency components of the audio signal will be reduced.

Maximum bandwidth occurs with the LOW CUT control fully counterclockwise, and the HIGH CUT control full clockwise. If you are unsure check the SUB Display.



SSB SLOPE TUNE (HIGH CUT, LSB) control

CW VBT (Variable Bandwidth Tuning) control

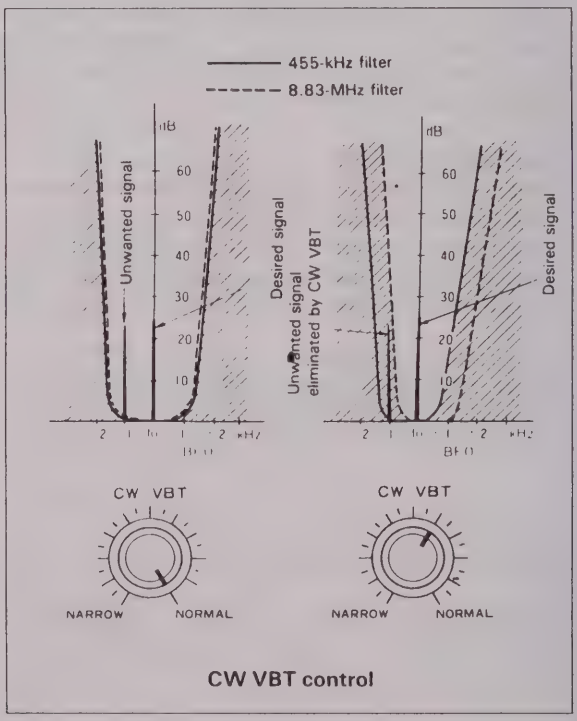
This control is very similar to the SSB Slope Tuning controls. However, with the CW VBT control both sides of the IF passband are narrowed at the same time. The actual range depends upon the CW filters that have been installed. A description of the different possibilities follows:

(i) When the filter bandwidth is 2.4 kHz (no filters) the passband varies from 2.4 kHz to 600 Hz.

(ii) When the optional YK-88C-1 (8.83 MHz, 500 Hz filter) or the YG-455C-1 (455 kHz, 500 Hz filter) filter is installed the passband varies from 500 Hz to approximately 150 Hz.

(iii) In general the optional YG-455CN-1 is not recommended for use with the CW VBT circuit. This is because the widest position is only 250 Hz.

Since the optional filter center frequency is 700 Hz higher than that of the built-in 2.7 kHz filter, the CW receive tone will be about 800 Hz without using the PITCH control. VBT operation is illustrated in the Figure at the right.



CW VBT control

5-11. VOX OPERATION (Voice Operated Transmit)

Depress the VOX switch ①. While speaking into the microphone, increase the VOX GAIN control (A) until the VOX relay just operates. Clockwise rotation of this control will increase the sensitivity. For VOX operation it is sometimes desirable to "Close-Talk" the microphone in order to prevent background noises from tripping the transmitter.

1. Check that the ALC reading on voice peaks is still within the ALC zone on the meter. If necessary, readjust the MIC gain control for the proper ALC reading.
2. If the VOX circuit is activated by the output from the speaker, adjust the ANTI-VOX control (C) as necessary for proper VOX operation.
3. Do not use excessive VOX or ANTI-VOX settings. This may cause the VOX circuit to operate erratically. Use only the necessary control setting.
4. If the VOX circuit transfers between words, or holds too long, adjust the release time-constant using the DELAY control (B).

5-12. SPEECH PROCESSOR

During SSB operation (especially DX operations), it may be desirable to increase the relative "talk-power" of the transmitter by using the speech processor circuitry. This may make the difference between a marginal, and a copyable signal.

- **Operation**

  Turn the PROCESSOR switch ⑤① ON and place the meter switch to COMP. Adjust the PROCESSOR IN control ⑤② while speaking into the microphone in a normal tone of voice, for a peak COMP scale reading of no more than 10 dB. Do not overdrive the COMPRESSOR. This will deteriorate voice quality, increase transmitter noise level, and in general make copying your signal more difficult.

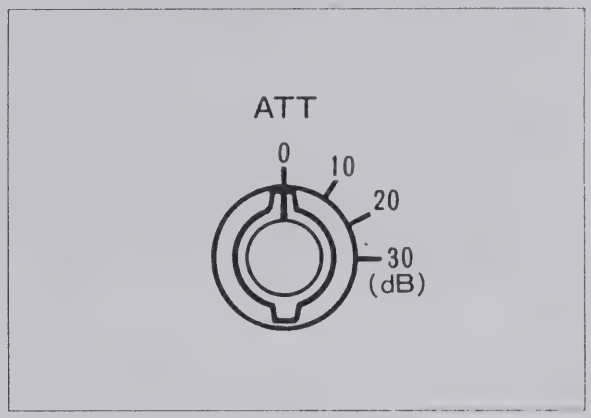
  Next, set the METER switch to ALC and adjust the PROCESSOR OUT control ⑤③ while speaking into the microphone. Ensure that the meter deflection is within the ALC zone !

5-13. OTHER CONTROL AND SWITCH FUNCTIONS

- **⑦ ATT switch**

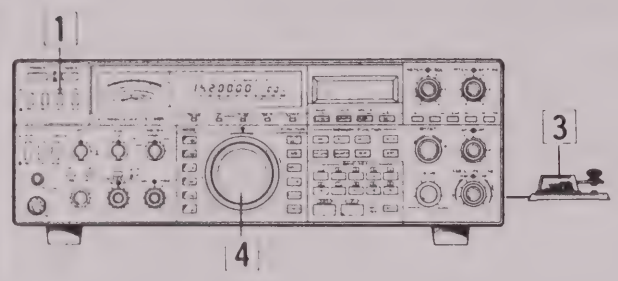
A strong adjacent signal may occasionally conceal a weaker nearby signal, or the S meter may deflect off-scale when the receiver is tuned to a strong local signal. The input to the RF amplifier may be attenuated by 10, 20 or 30 dB using the RF ATT switch.

This will help to reduce or eliminate interference and distortion from these stronger stations.



5-9. ZERO BEATING

In CW operation equalizing your receiving frequency with that of your transmit is called "Zero beating". The TS-940S enables you to zero beat in the following manner.

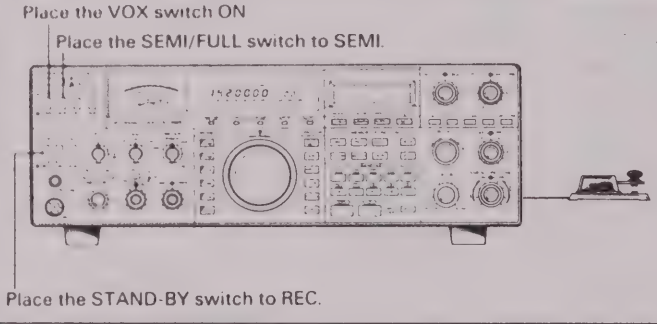


1. Set the MONI switch (monitor) to MONI.
2. If the VOX switch is ON, set it to OFF and depress the key with reception mode.
3. A side tone is heard from the speaker.
4. Adjust the main tuning control so that the transmit frequency of the station you are receiving is equal to the side tone frequency.
   Now, zero beating is completed.

5-10. CW BREAK-IN

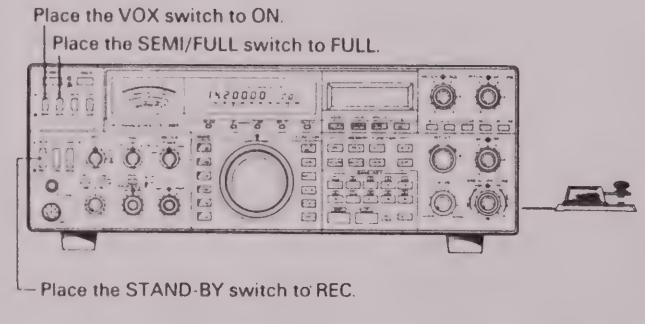
During CW operation, the transceiver will automatically enter transmission mode when the key is depressed, if the VOX switch is turned ON in the standby mode.
There are two break-in modes available with the TS-940S.

Semi break-in



The TS-940S will now transmit whenever the CW key is closed. Adjust the VOX DELAY control so that the transceiver remains keyed between words.

Full break-in



The transceiver will now immediately switch back to receive whenever the CW key is opened, allowing you to receive between dots/dashes. This feature is convenient when operating DX, Contests, or just Rag chewing by allowing a quicker response to incoming calls.

Notes:

Full Break-in operation is not possible with the TL-922(A) linear amplifier.
Make sure your linear amplifier is capable of full QSK operations.

This unit has a built-in side tone oscillator circuit which allows you to monitor your own sending.

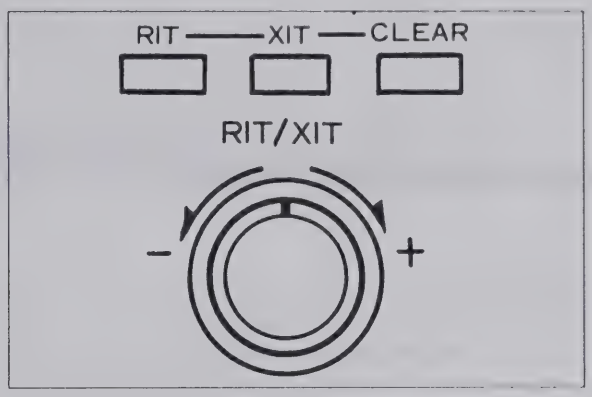
● ㉝RIT/XIT control

○ RIT:

First, cancel any previously programmed offset using the CLEAR key, then turn the RIT switch ON.

The RIT control allows shifting the receiver frequency ±9.99 kHz. The RIT display will show the offset to the nearest 100 Hz. Use of the RIT control will not affect the transmit frequency.

When the RIT switch is ON, the RIT indicator will light, and the receive frequency can be adjusted by using the RIT control. Pressing the CLEAR switch restores the RIT to the previous status.



Note:

When the RIT is ON the transmit frequency may be different from the receive frequency. For normal operation leave the RIT switch OFF. It should be used only when necessary.

○ XIT (Transmitter Incremental Tuning)

Transmitter Incremental tuning is very similar to RIT (Receiver Incremental Tuning). XIT is only active in the transmit mode. By using the XIT function it is possible to offset the transmit frequency without the normal loss of receiver audio that is experienced when using the SPLIT function.

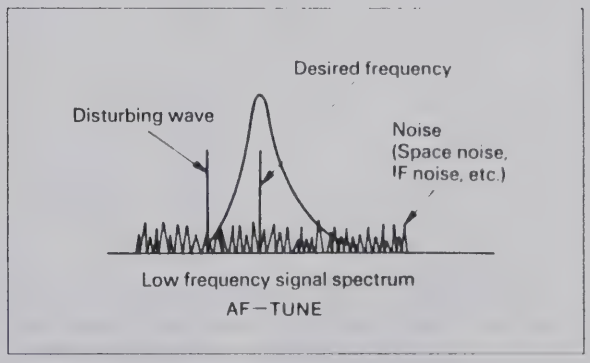
Offsets of ±9.9 kHz are possible.

The RIT/XIT offset can be preset, without affecting the actual operating frequency by turning OFF the XIT/RIT and using the RIT/XIT display to determine the offset.

● AF TUNE

The AF TUNE circuit is just the opposite of the NOTCH circuit. With this control it is possible to accentuate the desired signal by providing additional rejection of noise and interfering signals whose pitch (tone) falls outside the audio passband.

Turn the AF TUNE switch ON and adjust the AF TUNE control to peak the desired signal.

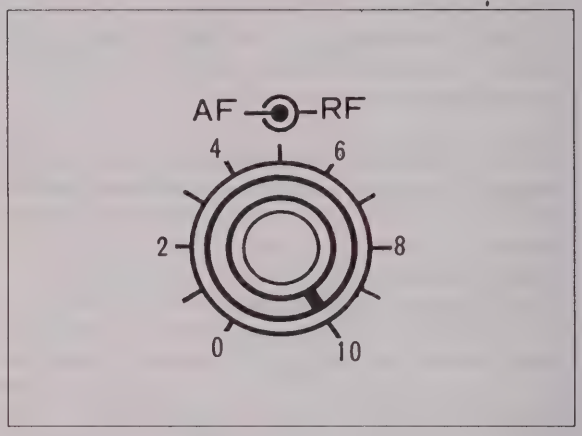


● ㊴ PITCH control

The CW PITCH control is provided so that you may adjust the pitch or tone of the incoming CW signal so that the tone is pleasing to you. The TS-940S accomplishes this without shifting the actual transmit or receive frequency, by shifting the 100 kHz IF frequency, just prior to Product Detection.

● **RF GAIN CONTROL**

RF GAIN is controlled by changing the AGC threshold voltage. Adjust the RF GAIN so the S-meter reading increases to a point just lower than speech peaks. This also reduces noise during reception. For normal operation, this control should be turned fully clockwise for maximum sensitivity.

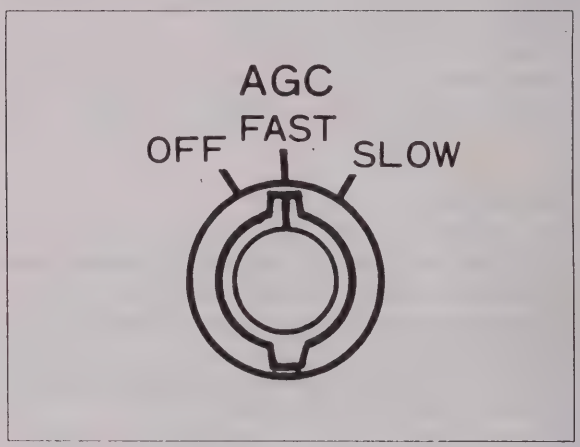


● **AGC switch**

The AGC control is normally set as follows:

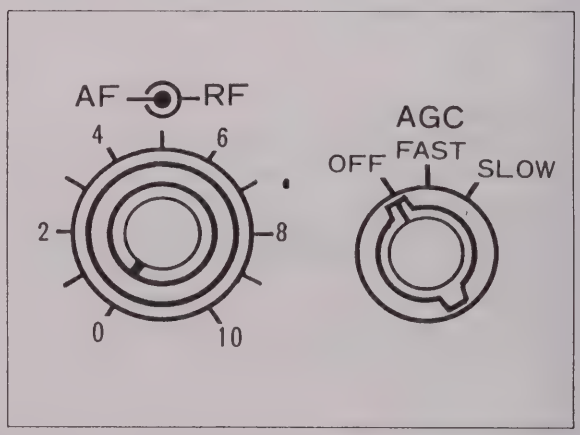
FAST	CW, FSK
SLOW	SSB
OFF	Weak signal reception

The S-meter does not function in the OFF position.



Simultaneous use of the RF GAIN control and AGC switch may be of assistance when strong local signals are present. If a strong signal (such as a local amateur radio station) appears near the desired receive signal, the S-meter may show unusual deflection due to the AGC voltage that is developed as a result of the strong meter being signal. If this occurs, turn the RF GAIN down so the meter pointer remains at approximately the original deflection peak, and turn the AGC switch OFF.

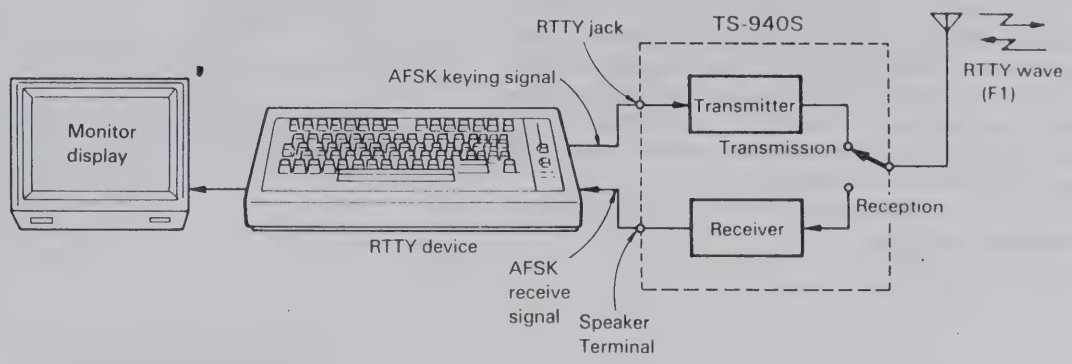
This will eliminate the unwanted AGC voltage and permit clear reception.



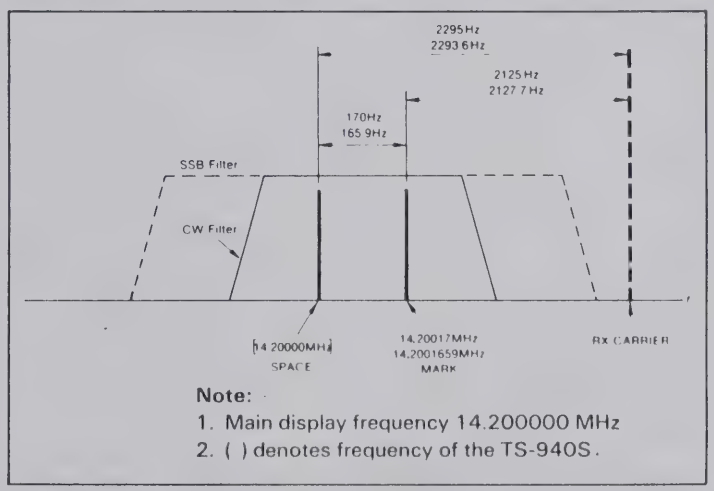
RTTY SYSTEM

The TS-940S will adapt to Slow Scan Television or AFSK (Audio Frequency Shift Keying) RTTY operation.
For SSTV, the PHONE PATCH IN jack should be connected to the Camera output. The PHONE PATCH OUT jack should be connected to the monitor input.

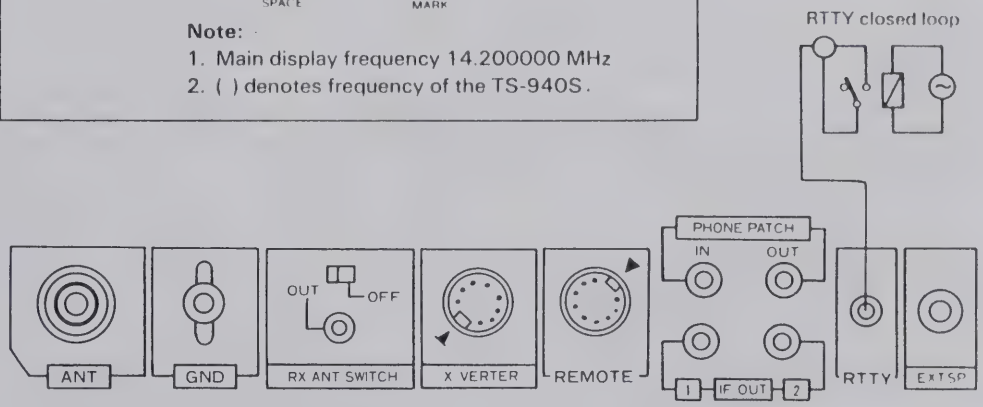
For AFSK operation, connect the Tone Unit output to the Phone Patch input, and Phone Patch output to the Tone Unit input.



The figure below shows the frequency relationship between receive and transmit with the TS-940S. In FSK operation the space frequency is indicated on the main display.



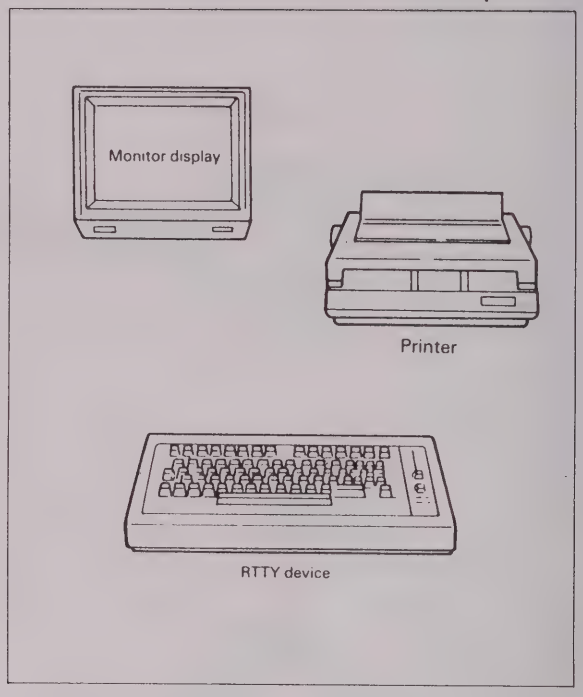
Note:
1. Main display frequency 14.200000 MHz
2. ( ) denotes frequency of the TS-940S.



5-14. RTTY

RTTY operation requires a demodulator and a teletypewriter. A demodulator including 2,125 and 2,295 Hz (170 Hz shift) filters, will be acceptable and may connected directly to the PHONE PATCH OUT jack. To use the transceiver's FSK circuit with older high voltage teletype equipment, you must use an external keying relay in the teletypewriter closed loop, and connect the relay contacts to the rear-panel RTTY KEY jack.

During FSK operation, the SPACE frequency is shown on the display.



■ ACC jack

ACC1 jack

This jack is designed for connection of the 6-pin DIN connector supplied with the optional interface unit.

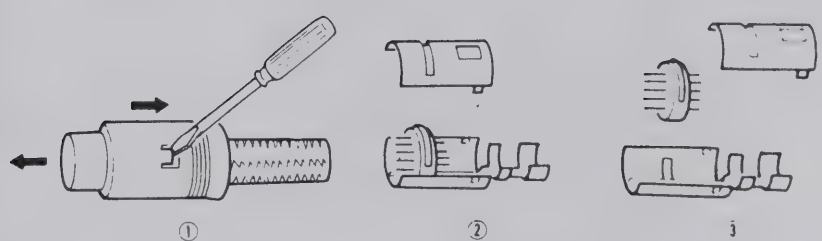
ACC2 jack

Terminal numbers and their applications are as follows:

Pin No.	Pin Name	Application
1	ACC SW	
2	ACC SW	
3	Data output	Output level is fixed regardless of the AF control setting. Output voltage: 300 mV or more at maximum receiving input with 4.7 kΩ load.
4	GND	Grounding (The shielded wire of the audio output terminal is connected here.)
5	NC	No connection
6	NC	No connection
7	NC	No connection
8	GND	Grounding
9	MIC mute	Signal input from the MIC jack is muted. Grounding mutes signal.
10	NC	No connection
11	Data input	Input terminal for data communication. In SSB, MIC gain can be controlled by the MIC control. Input voltage: 500 mV or less (SSB: Voltage starts deflecting ALC FM: Voltage providing ± 3.0 kHz deviation.)
12	GND	Grounding (The shielded wire of the audio input is connected here.)
13	Stand by	Standby terminal. (PTT line)

13 pin DIN plug supplied

View from the rear panel



Seperate the metal assembly and the nylon cover with the lock-tab released as shown. To reassemble, reverse the setps ③ ~ ①.

Disassembling the plug

5-15. CONNECTORS

Operation with a Linear Amplifier

The TS-940S may be operated with any conventional linear amplifier which will accept up to approximately 125 watts of RF drive, has a low current DC operated keying circuit, and returns approximately –8 to –10 vdc ALC back to the exciter. Please note that in order to operate full QSK (full break-in) the linear amplifier must also be QSK capable.

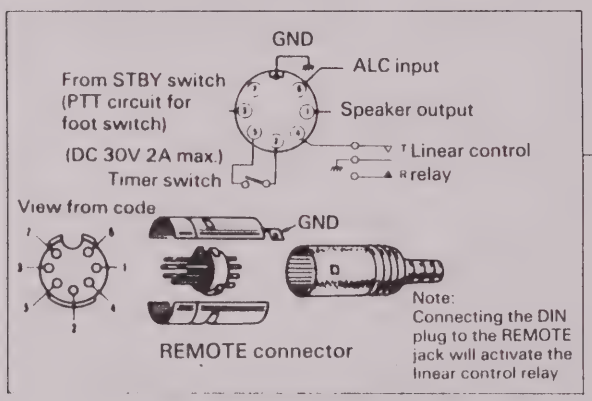
Refer to the REMOTE connector diagram.

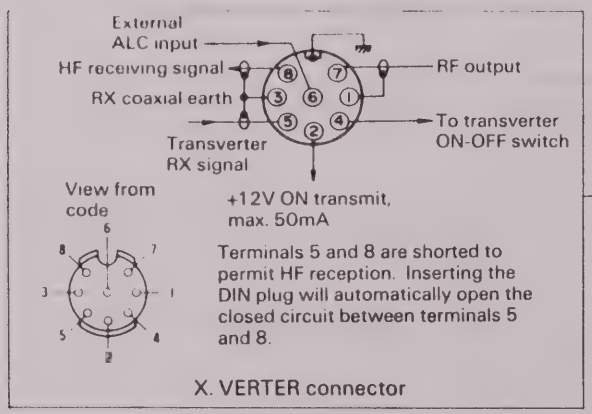
Pin 6 ALC input

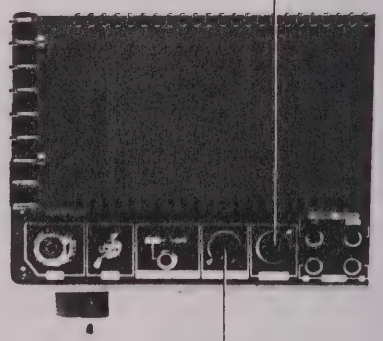
Pin 2 Ground

Pin 4 Control line center conductor

Initial linear amplifier tune-up should be performed with the TS-940S set for 50 watts output to reduce wear and tear on both the linear, and the TS-940S. Use of a dummy load is strongly recommended, since the bands are already sufficiently crowded.





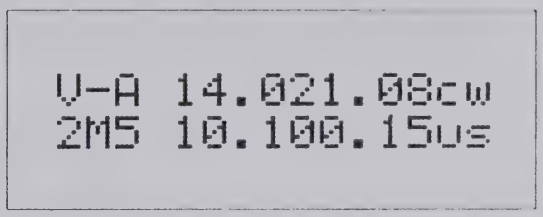


PIN	Function	PIN	Function
1	Ground	5	Xvrtr input (RX)
2	Relay Control (+ on TX)	6	Xvrtr ALC input
3	Ground	7	Xvrtr output (TX)
4	Xvrtr ON-OFF control	8	HF ANT output

6-2. MEMORY RECALL

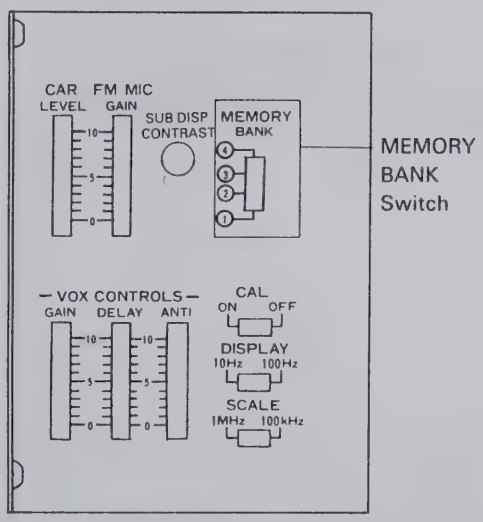
1. Select the desired memory bank using the MEMORY BANK switch on the top panel.
2. Press the VFO/M key so that MEMO A or B appears in the Main display.
3. Press the desired memory channel number using the BAND/KEY switches.
4. By using the SCROLL switch you can review the contents of the Memory Bank. Each time you depress the switch you will advance one memory channel. An example is shown in the figure at the right. Pressing and holding the SCROLL switch will cause the display to sequentially display the memory bank contents.

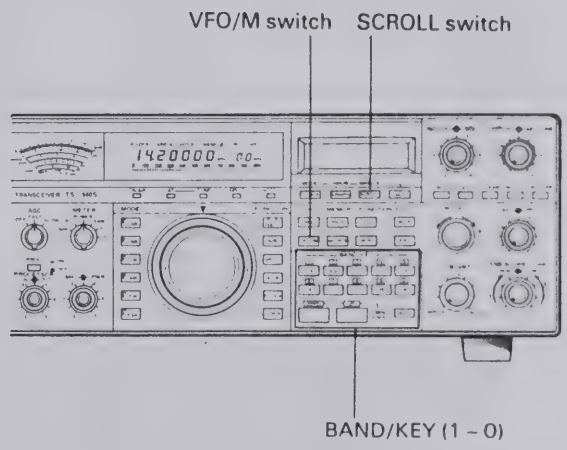
The main display indicates memory channel data.



Example Sub-display

Top cover section





6. MEMORY OPERATIONS

The TS-940S provides 40 memory channels in 4 groups of 10 memories each. A MEMORY BANK switch is provided, under the sliding top cover, to select the desired memory bank. The Main Display shows which of the 10 memories has been selected in each group. The TS-940S stores both frequency and mode.

6-1. MEMORY CHANNEL ENTRY

1. Select the desired memory bank using the MEMORY BANK switch on the top panel.
2. Select the desired operating frequency and mode using any desired method.
3. Press and hold the M.IN key.
4. Press the desired memory channel number using the number printed over the BAND/KEY switches as a guide.

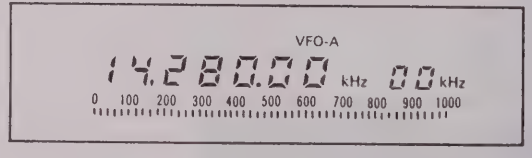
For example, to store 14.250.0 into memory channel 25:

1. Select the second group of memories by placing the MEMORY BANK switch to 2.
2. Press the 14 MHz BAND switch.
3. Use the Main Tuning Dial to select 14.250.0 MHz.
4. Press and hold the M.IN key.
5. Press the [5/14 MHz] key to store the frequency in memory. A beep will sound to confirm data entry.
6. Release the M.IN key.

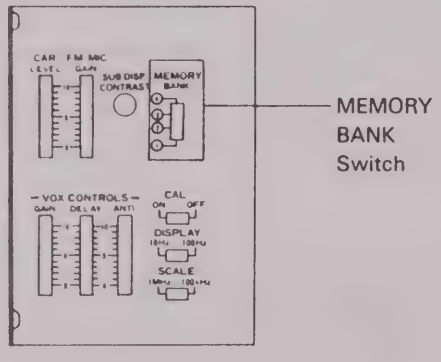
Note:

If the display indicates MEMO (A or B) you will not be able to enter a memory channel. You must first select VFO operation by pressing the VFO/M switch.

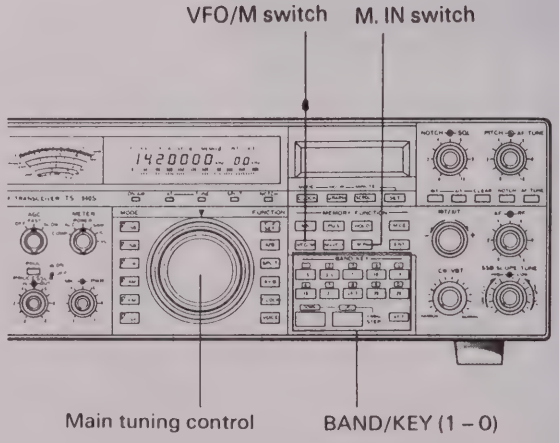
If the main display indicates MEMOR A or B press the VFO/M switch.



Top cover section



Front panel

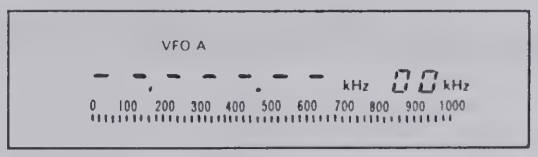


6-5. DIRECT KEYBOARD FREQUENCY ENTRY

Direct entry of the desired frequency is also possible with the TS-940S transceiver.

1. Select VFO operation.
2. Press the ENT key. The display will indicate as in figure (I).
3. Enter the desired operating frequency from the Most Significant Digit to the Least Significant Digit.
4. After all the digits have been entered, press the ENT key again. It is not necessary to enter trailing zeros.

For example: To enter 14.200.00 press the following keys, in the indicated order.
[ENT], [1], [4], [2], [0], [0], [0], [0]



(I)

(II)

Note:

Attempting to enter a frequency outside the range of 30 KHz – 30 MHz will cause the display to revert to the figure shown in (I).

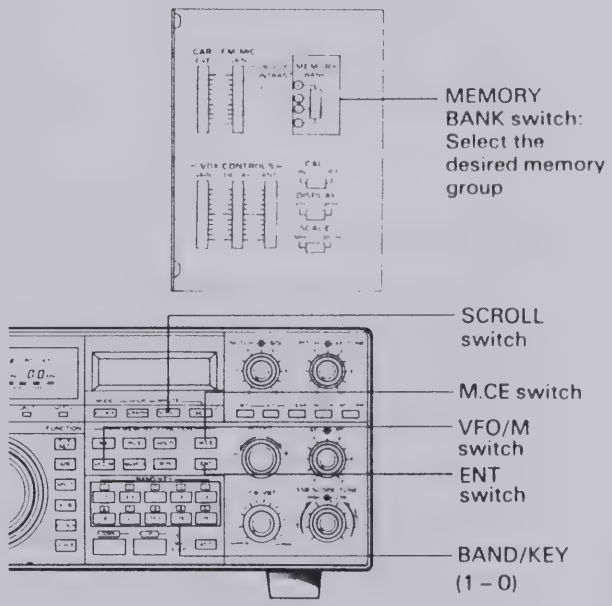
When frequencies are entered down to the nearest 10 Hz, it is not necessary to press the ENT key, for the last digit.

6-6. CLEARING MEMORY

Memory scan speed may be effectively increased by erasing unwanted memory channels.

Procedure:

1. Press the SCROLL switch to review the contents of the memory.
2. Select the desired memory group with the MEMORY BANK switch.
3. Select VFO operation with the VFO/M switch.
4. To erase the data, press and hold the M.CE switch and then the BAND/KEY switch that corresponds to memory channel you wish to erase. The SUB display will clear indicating the memory channel has been cleared.



6-3. MEMORY SCAN

Memory scan operates within any memory channel group, in 4 second intervals. Memory channels with no data entered are skipped during Memory Scan.

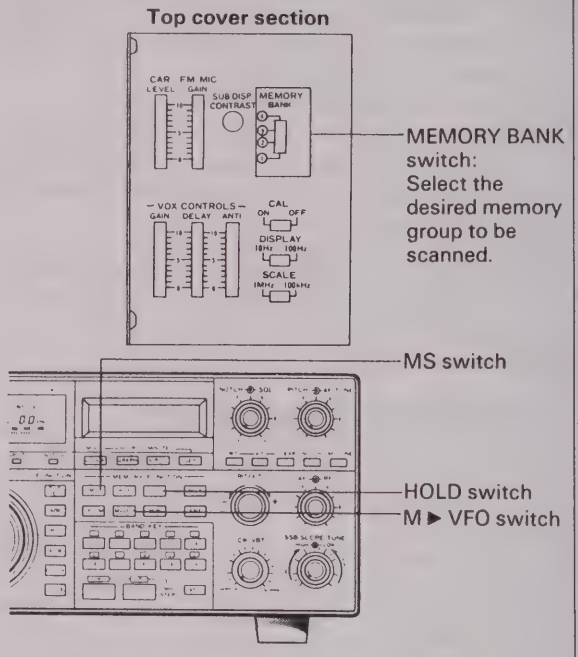
To initiate Memory Scan:

1. Select the desired memory channel group using the MEMORY BANK switch on the top panel.
2. Press the MS key. Scan will start immediately.

Note:

Once the desired memory channel is found the data can be easily transferred to the active VFO. To shift the data to the VFO, press the HOLD switch and then the M ► VFO switch. Pressing the M ► VFO switch releases the MS and HOLD functions. To resume Memory Scan, simply press the MS switch.

If there is no data stored in any of the 10 memory positions of a group, a triple "BEEP" will sound to signal an error.

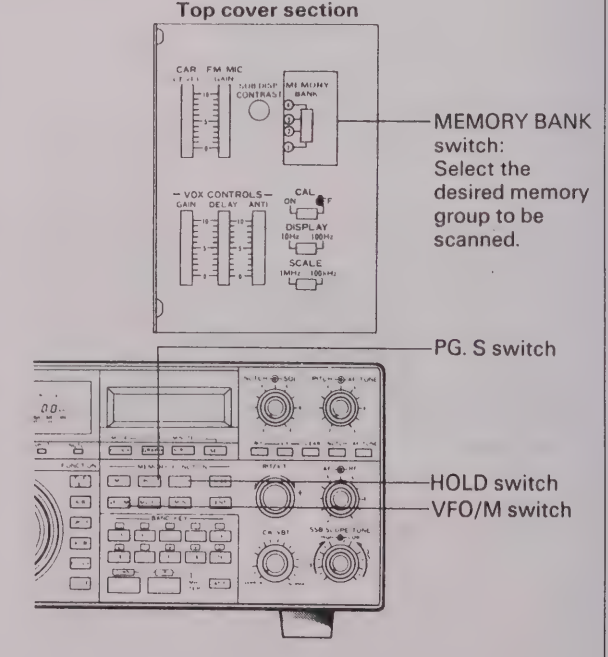


6-4. PROGRAM SCAN

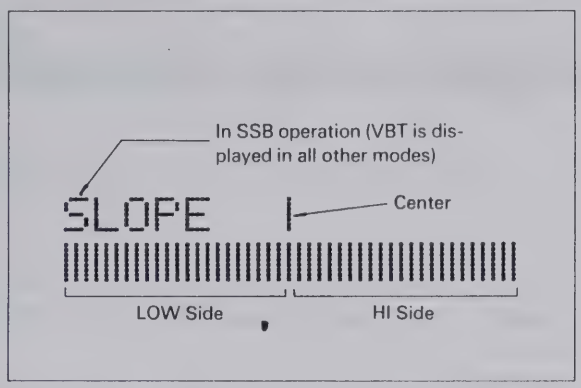
Programmable scan will scan between the limits set in memory channels 9 and 0. Since there are 4 banks of memories, this means that you can program up to 4 different program scan limits. Scan proceeds from the lower channel to the upper channel. Either channel 9 or 0 may hold the lower frequency. If either channel contains no data, the Program Scan will not start, and a triple "BEEP" will sound to signal an error.

To initiate Program Scan:

1. Select the desired memory channel group with the MEMORY BANK switch.
2. Ensure the transceiver is in the VFO mode. (Program scan will not work in the Memory mode.)
3. Press the PG.S switch to start scan.
4. To pause during Program Scan press the HOLD switch. To resume scan release the HOLD switch.
5. To release PG.S press the PG.S switch.



7-2. GRAPHIC DISPLAY

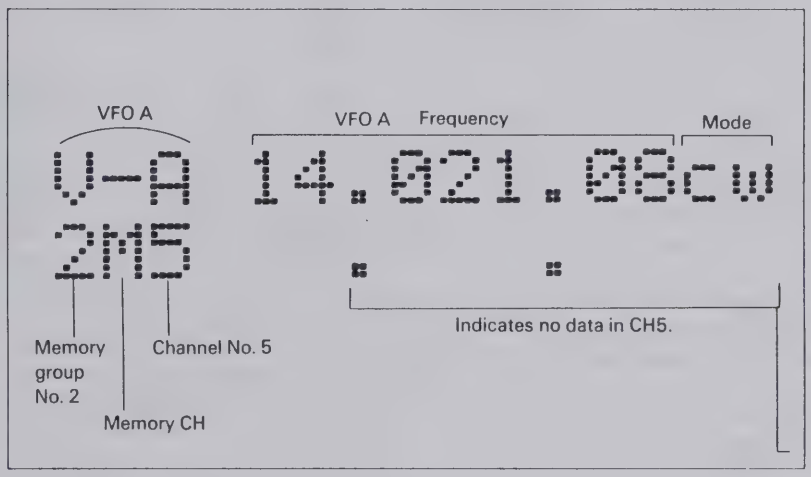


When the GRAPH key is pressed, either "SLOPE" (SSB) or "VBT" (all other modes) will be displayed along with a graphic illustration of the relative passband width.

Notes:

1. This display does not show the exact bandwidth, but is included to provide a quick visual reference only.
2. If the CW VBT control is rotated quickly, the graphic display may not immediately respond to this input. A slight delay is normal, in this instance.
3. If any function of the Sub-display fails to function properly, turn the power switch OFF and then ON to reset the microprocessor.

7-3. FREQUENCY DISPLAY



When in the VFO mode the upper row of the Sub-display will show the idle VFO, its frequency and mode. When in the memory mode the upper row of the Sub-display will show the active VFO, its frequency and mode. The lower row of the sub-display will show the active VFO when in the VFO mode, and memory channel information when in the memory mode.

Notes:

1. If the SCROLL key is pressed and held the sub-display will scan through the contents of the current Memory Group, and the active VFO.
2. The frequency displayed in the sub-display for the VFO does not include any RIT/XIT offsets.

Mode	Indication
LSB	LS
USB	US
CW	CW
AM	AM
FM	FM
FSK	FS

7. SUB-DISPLAY FUNCTION

The Sub-Display provides four different types of information:
(1) Timer
(2) Graph
(3) Frequency
(4) Antenna Tuner Status
Items (1), (2), and (3) can be selected by pressing the CLOCK, GRAPH, or SCROLL switches respectively. Item (4) however, is selected whenever the Antenna Tuner function has been activated.

7-1. SETTING THE CLOCK

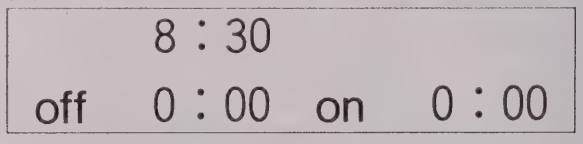
The Clock is programmed with the SET, GRAPH, SCROLL, and CLOCK keys. The clock is a 24 hour clock.

Setting the Current time:

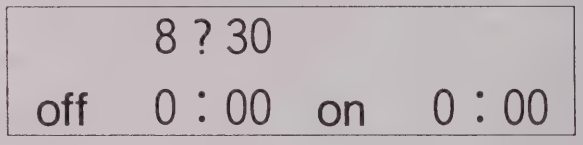
Example: Setting the clock to 12 : 00.

1. Press the CLOCK key to select the clock display.
2. Press the SET switch to prepare the clock for setting. A flashing "?" will appear on the upper clock position, as shown in figure (2).
3. By pressing the GRAPH key you can program the "Hours" position. Each time the GRAPH key is pressed the hour will advance by 1. Pressing and holding the key will cause the hours digits to count up sequentially. Use the SCROLL switch to set the minutes. Going past 59 minutes will not cause the hours digit to increment.
4. You may synchronize the time with a time standard by pressing the SET switch to "Zero" the seconds. (Seconds are not displayed.)
5. If you wish to clear the Timer displays on the lower row, press the CLOCK switch to move the flashing "?" to the lower left time display, as shown in (5). Then press and hold the SET switch for a few seconds.

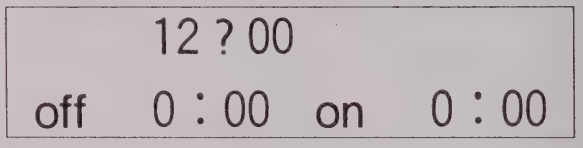
(1)



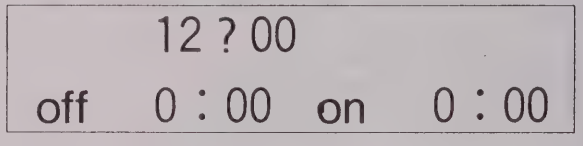
(2)



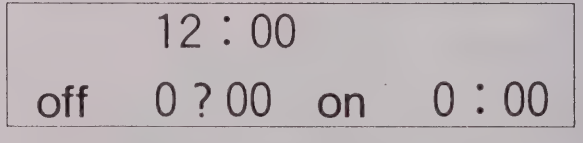
(3)



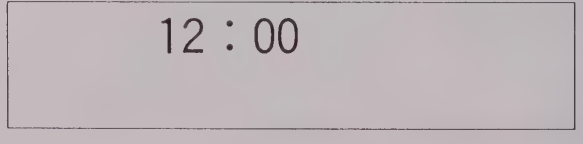
(4)



(5)



⇩



Programming the TIMER

Always ensure that the TIMER switch is OFF before attempting to program the timer.

■ Example 1: Disabling the timer

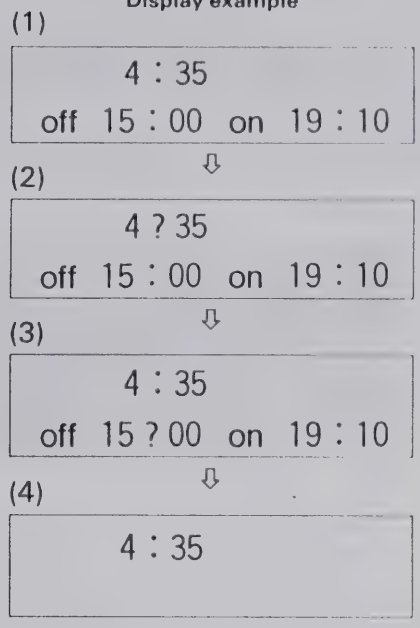
1) Press the CLOCK switch to select the clock display.

2) Press the SET switch. A flashing "?" will appear in the top display.

3) Press the CLOCK switch to move the flashing "?" to the lower left timer display.

4) Press and hold the SET switch for 0.5 seconds or longer. Both timer displays will blank and only the clock display will appear. The timer is now inactive, and the TIMER switch on the front panel will not function.

Display example



■ Example 2: Setting the timer for Single Execution (ON at 13 : 00)

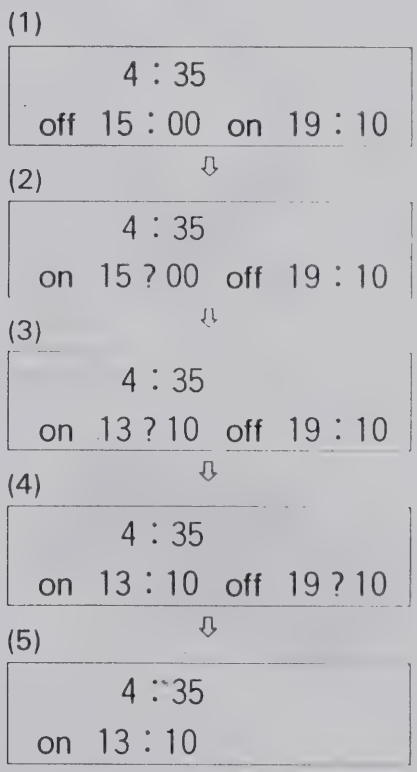
1) Press the CLOCK, SET, and then the CLOCK key to cause the flashing "?" to appear in the lower left (execution) display.

2) Whether you want to execute an ON or OFF operation may be selected by using the SET key. Pressing the SET key will cause the "Execution" display to alternate between ON or OFF.

3) Use the GRAPH (hour) switch to select "13", and the SCROLL (minute) switch to select "00". Pressing either the GRAPH or the SCROLL switch will cause the selected figure to advance sequentially.

4) Press the CLOCK switch and the flashing "?" will appear in the lower right display.

5) Press and hold the SET key for 0.5 seconds or longer. This will turn OFF the lower right display. The "Clock" and "Execution" displays will remain ON.



8. TIMER FUNCTIONS

The timer has three functions. It functions when the TIMER switch is set to ON.

Timer	MODE	DISPLAY
TIMER OPERATION	(A) Non-active mode (clock display only) In this mode, the timer does not function even when the TIMER switch is on.	4 : 35
	(B) Single mode (Transceiver "ON" or "OFF") In the example at right the transceiver is OFF. When the transceiver has switched ON the timer will automatically revert to the non-active mode, and the timer will reset to 0 : 00.	4 : 35 on 13 : 10 This setting can be confirmed by turning the TIMER switch OFF.
	(C) 24 Hour single event timer In the example at right the transceiver will turn ON at 13 : 10 and will be switched OFF at 4 : 50 the next day. The timer always displays the next operation to be performed in the lower left position. In our example, after the radio has turned ON at 13 : 10 the display will change and the OFF time of 4 : 50 will be displayed in the lower left position.	4 : 35 on 13 : 10 off 4 : 50 ⇩ 13 : 10 off 4 : 50 on 13 : 10 Execution time Next execution time

9. OPTIONAL ACCESSORIES

9-1. PERIPHERAL DEVICES AND OPTIONS

The following optional accessories are available for more efficient and enjoyable operation of the TS-940S.

■ AT-940 AUTOMATIC ANTENNA TUNER

The TS-940S is available either with or without a built-in automatic antenna tuner. The tuning range is automatically pre-selected at band selection. Reflected power and final stage Ic (collector current) are monitored to control the tuning motors for the lowest SWR.
The tuner covers all amateur bands from 160 through 10 meters, including the new WARC bands. Matching capability is 20 to 150 ohms, unbalanced. The front panel "AUTO-THRU" switch allows bypassing the tuner, if desired.

■ SPEAKER SP-940

The SP-940 is a low-distortion speaker with selectable frequency response for high intelligibility in any mode.
The frequency response is shaped by selectable built-in audio filters, which are effective in improving the signal-to-noise ratio under certain interference conditions, or when receiving weak signals.

SP-940

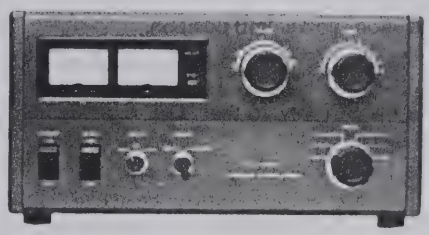
■ STATION MONITOR SM-220

Built around a basic 10 MHz oscilloscope, the SM-220 station monitor features, in combination with a built-in two-tone generator, a variety of waveform-observing capabilities.
In addition the TS-940S provides the capability of "Pan display" or spectrum analysis of band activity when the optional BS-8 is used with the SM-220.

SM-220

■ HF LINEAR AMPLIFIER TL-922/TL-922A

The TL-922 is an HF linear amplifier that employs a pair of 3-500Z high performance transmitting tubes. Coverage is provided for 160 – 10 meters. Coverage is not provided for the WARC bands.
The TL-922A is available only in the U.S.A and does not cover the 10 meter band as delivered from the factory. The linear is easily converted for use on 10 meters by the owner.



TL-922

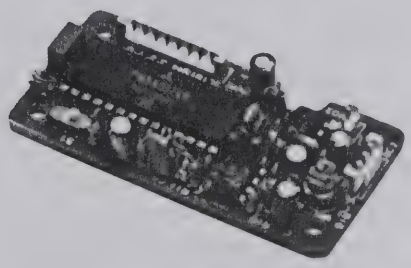
■ HS-4 COMMUNICATIONS HEADPHONES

■ HS-5 COMMUNICATIONS HEADPHONES

Headphones designed for communications equipment. These light-weight open air-type headphones remain comfortable during extended operation. Easily attached ear-pads are provided.

HS-5

■ VS-1 VOICE SYNTHESIZER



VS-1

■ **Example 3: Programming the 24 hour timer (ON 13 : 10/OFF 4 : 50)**

1) Press the CLOCK key to select the Clock display.

2) Press the SET switch. The flashing "?" should appear in the Clock position.

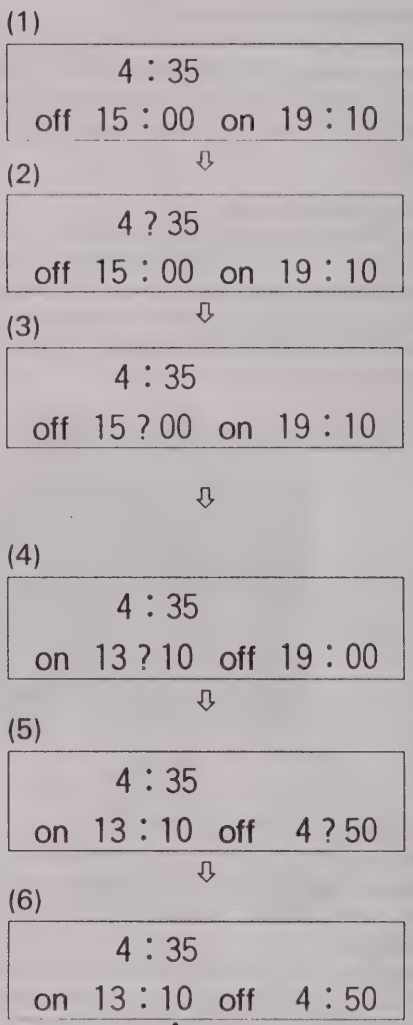
3) Press the CLOCK switch to move the flashing "?" to the "Execution" (lower left) position.

4) Press the SET key so that "ON" appears in the "Execution" display.

5) Press the GRAPH key to set the hour to "13". Press the SCROLL key to set the minute to "10".

6) Press the CLOCK key to move the flashing "?" to the lower right position. Use the GRAPH and SCROLL keys to select "4:50".

7) Press the CLOCK key. The flashing "?" will disappear, and all 3 display positions will remain ON.



9-2. INSTALLATION OF ACCESSORIES

1. Preparation

(1) Prepare the following tools.
- ○ No. 2 Philips screwdriver
- ○ Diagonal cutters

(2) Unplug the power cord from the AC outlet before starting work.

(3) Remove the 8 top and 8 bottom case screws and remove the covers.

9-3. OPTIONAL FILTER INSTALLATION

(1) Install the filters at the appropriate locations on the signal unit. Tighten the supplied mounting screws. If any of the capacitors that are mounted on the signal unit interfere with filter installation, they may be "gently" bent out of the way.

■ **YK-88A-1**

Remove jumper wire W21 from the YK-88A-1 position with a diagonal cutter.
Install the YK-88A-1 and tighten the supplied mounting screws.

■ **YK-88C-1**

Remove jumper wire W22 from the YK-88C-1 position with a diagonal cutter.
Install the YK-88C-1 and tighten the supplied mounting screws.

■ **YG-455C-1 or YG-455CN-1**

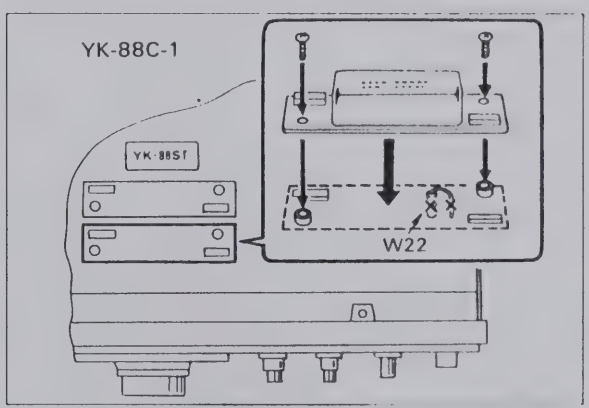
Remove jumper wire W31 from the YG-455C(N)-1 position with a diagonal cutter. Install the YG-455(N)-1 and tighten the supplied mounting screws.

COMBINATION OF IF FILTERS

MODE switch	NAR-WIDE switch	883 MHz IF	455 kHz IF	Overall pass-bandwidth	SSB SLOPE TUNE	CW VBT	AF TUNE *2	NOTCH	Note
SSB *4	WIDE or NARROW	2.4 kHz (Stock)	2.4 kHz (Stock)	2.4 kHz	HI-CUT to 1500 Hz LOW-CUT to 700 Hz	–	–	Yes	
CW/FSK *2	WIDE	2.4 kHz	2.4 kHz	2.4 kHz	–	600 Hz ~ 2.4 kHz	Yes	Yes	
	NARROW *1	(YK-88C-1 500 Hz)	(YG-455C-1 500 Hz)	500 Hz	–	150 Hz ~ 500 Hz	Yes	Yes	Filter combination recommended for CW VBT
		2.4 kHz	(YG-455CN-1 250 Hz	250 Hz	–	*3	Yes	Yes	For narrower
AM	WIDE	– (YK-88A-1 6 kHz)	6 kHz 6 kHz	6 kHz 6 kHz	– –	– 4 ~ 6 kHz	–	Yes	
	NARROW	2.4 kHz (YK-88A-1 6 kHz)	2.4 kHz 2.4 kHz	2.4 kHz 2.4 kHz	– –	600 Hz 2.4 kHz* *3	–	Yes	

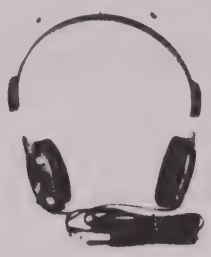
Table 9-1

Note:
( ) = Optional filter installed.
*1 Shows recommended optional filter combination for CW.
*2 AF TUNE in FSK mode does not work.
*3 Although VBT circuit operates, not recommended.
*4 No optional SSB filters.



■ **HS-6 COMMUNICATIONS HEADPHONES**

Deluxe, very light-weight headphones designed for communications equipment.



HS-6

■ **HS-7 MICRO HEADPHONES**

■ **MC-42S HAND HELD MICROPHONE**

■ **MC-60A BASE STATION MICROPHONE**

Communications microphone with push-to-talk and remote frequency UP/DOWN switches.

MC-60A

■ **HS-7 MICRO HEADPHONES**

■ **MC-80 BASE STATION MICROPHONE**

■ **MC-85 BASE STATION MICROPHONE**

■ **PC-1A: PHONE PATCH**

(Available only where phone patch operation is legal.)

Hybrid phone patch with VU meter for null and audio gain measurements.

The PC-1A Phone Patch provides interface between the transceiver and telephone line.

Providing excellent performance, it is designed to provide high isolation between receive input and transmit output.

Its compact design permits easy installation in a limited space. (FCC Part 68 registered)

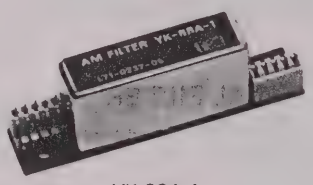
■ **SO-1: TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR FOR THE TS-940S**

The SO-1 is a crystal oscillator used for the purpose of further improving the frequency stability of TS-940S. (Oscillation frequency: 20 MHz, Range of frequency correction: ±60 Hz)

For AM

■ **YK-88A-1 (–6 dB bandwidth : 6 kHz, 8,830.0 kHz)**

Center Frequency:	8,830.0 kHz
Passband Width:	6 kHz (–6 dB)
Attenuation Bandwidth:	11 kHz (–60 dB)
Guaranteed Attenuation:	More than 80 dB



YK-88A-1

For CW

■ ***YK-88C-1 (–6 dB bandwidth : 500 Hz, 8,830.0 kHz)**

Center Frequency:	8,830.0 kHz
Passband Width:	500 Hz (–6 dB)
Attenuation Bandwidth:	1.5 kHz (–60 dB)
Guaranteed Attenuation:	More than 80 dB

YK-88C-1

■ ***YG-455C-1 (–6 dB bandwidth : 500 Hz, 455 kHz)**

Center Frequency:	455.0 kHz
Passband Width:	500 Hz (–6 dB)
Attenuation Bandwidth:	820 Hz (–60 dB)
Guaranteed Attenuation:	More than 80 dB

■ **YG-455CN-1 (–6 dB bandwidth : 250 Hz, 455 kHz)**

Center Frequency:	455.0 kHz
Passband Width:	250 Hz (–6 dB)
Attenuation Bandwidth:	480 Hz (–60 dB)
Guaranteed Attenuation:	More than 80 dB

YG-455CN-1

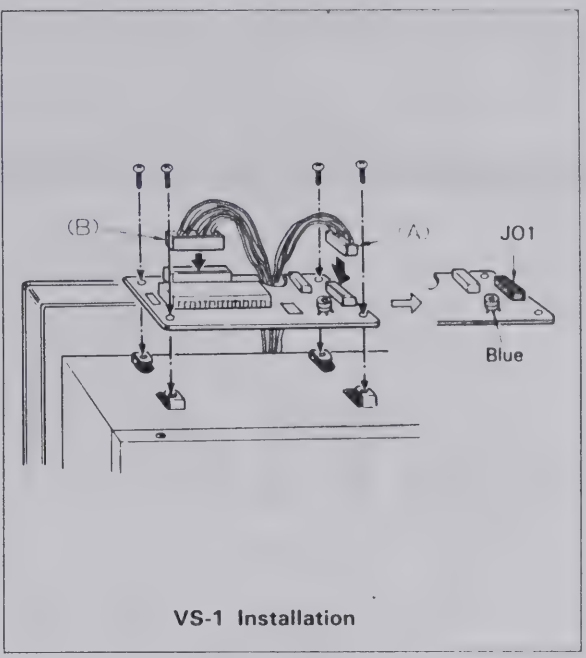
* **Recommended filter pair**

9-5. VS-1 INSTALLATION

Note:
Two 3-pin jacks are on the VS-1 pc board. The outer jack is J01. Use this jack when connecting.

When the VS-1 unit is installed, the displayed frequency is announced by synthesized voice.
To install, proceed as follows:

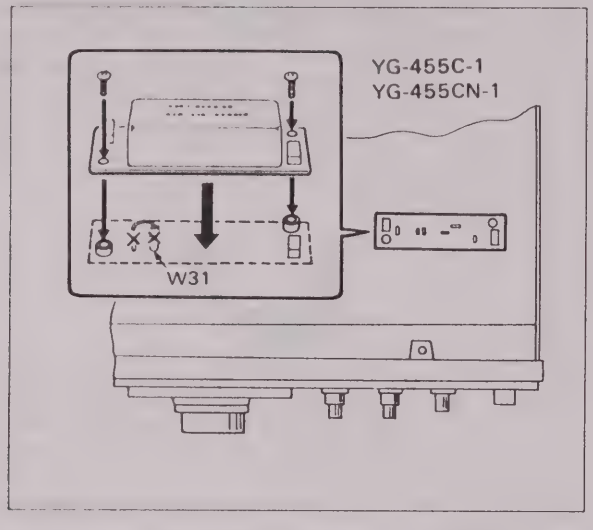
(1) Remove the top cover with a No. 2 Philips screwdriver.
(2) Place the VS-1 unit on the space shown in the figure and secure it with 4 screws supplied.
(3) Connect 3-pin (A) and 8-pin (B) plugs equipped with the TS-940S as shown to J01 (3-pin jack) and J02 (8-pin jack).

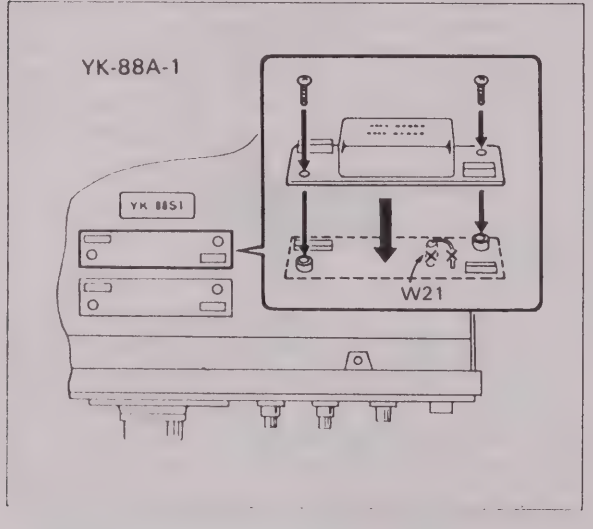


VS-1 Installation

9-6. SO-1 INSTALLATION

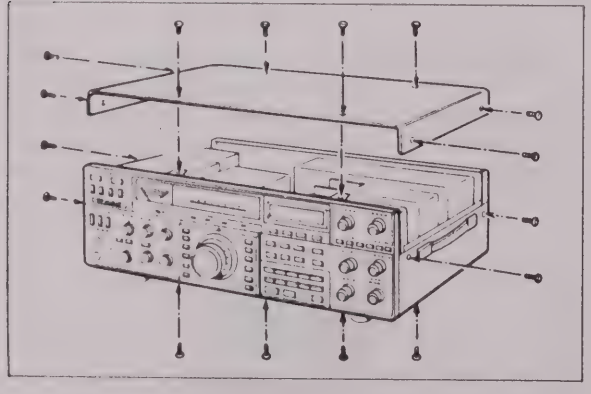
1. Disconnect Power before Proceeding!
2. Using a No. 2 Philips screwdriver, remove the transceiver top cover (8 screws).
3. Remove four screws from the Digital unit shield. Be careful of the wiring and protect the top edge of the front panel and the S-Meter terminals, when lifting the shield and digital unit forward. Reset the assembly on the top of the front panel with a cardboard or similar protective buffer so the panel is not marked or scratched.
4. Remove 8 screws securing the PLL unit.
5. Using a 45W (or less) soldering iron, remove those components from the PLL PCB from the space into which the SO-1 unit will be mounted.
   REMOVE: TC1, X1, Q1, C2 ~ 6, R1 ~ 4.
6. Before mounting the SO-1, clear the solder from the four mounting holes. Install the SO-1 unit as shown and solder its four posts to the PC board. Solder sparingly, and heat the connections only long enough to insure a good solder joint. Don't overheat the SO-1 or circuit board. Clip the SO-1 leads flush to the circuit board.
7. Before reassembly, verify digital display calibration. Note, however, that the adjustment is no longer available from the side of the transceiver, but is on top of the SO-1.
8. Remount the PLL unit and digital unit shield with top panel assembly. Note: During this procedure, be sure not to pinch any wires between the chassis and the PLL PCB or the digital unit shield and chassis. Watch the shield to S-Meter clearance during reassembly.



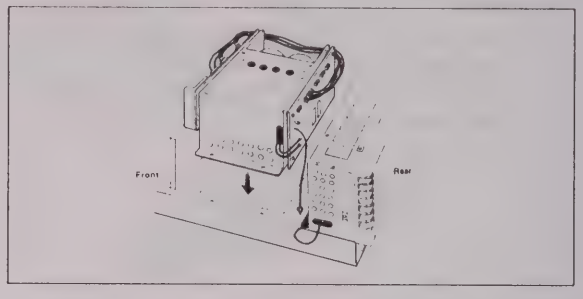


9-4. AT-940 INSTALLATION

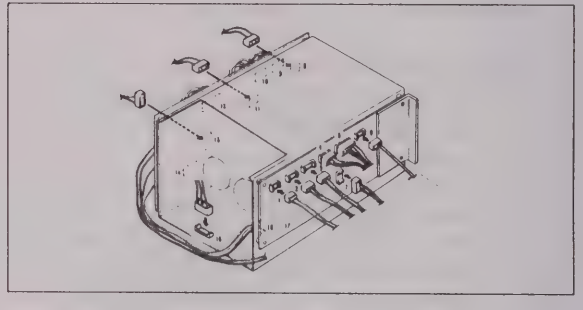
1. Remove the top and bottom covers as shown (16 screws).



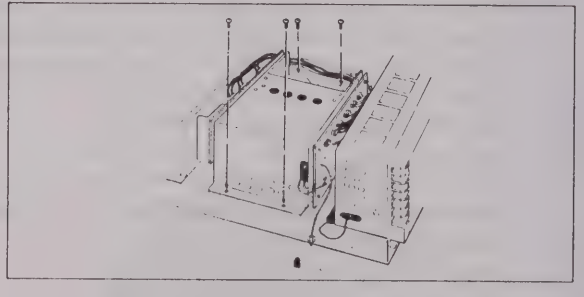
2. First place the AT-940 unit on the mounting space and insert a soft rag or some other such item to raise the AT-940 off the chassis for cable connection.



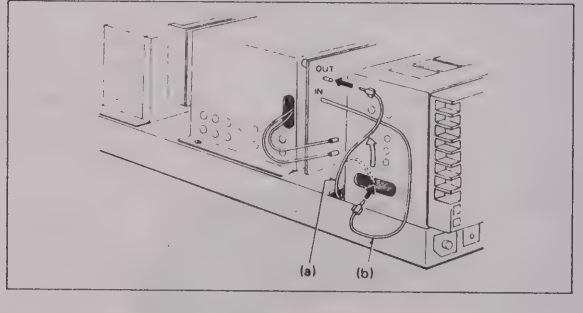
3. Connect the plus, using the numbers printed on each plug, and using the figure as a guide.



4. Remove the object that was inserted as a spacer and secure the AT-940 with the 4 screws provided.



5. Disconnect cable (a) and plug it onto the AT-940 OUT terminal as shown.
   Connect cable (b) as shown by the arrow.



Reverse the procedure in Step 1 to replace the top and bottom covers. This completes the installation of the AT-940.

OTHER OPERATIONS

■ PHONE PATCH OPERATION

Most phone patches will work satisfactorily without any modification to the radio. The PC-1A Phone Patch can be used with the TS-940S without modification to the patch. Operation will be as described in the PC-1A instruction sheet.

Recommended settings are:

PC-1(A)	RX Gain	4
	TX Gain	4
	Null as necessary	
TS-940S	Vox Gain	1
	AF Gain	4
	Mic Gain	5
	Anti Vox	Max

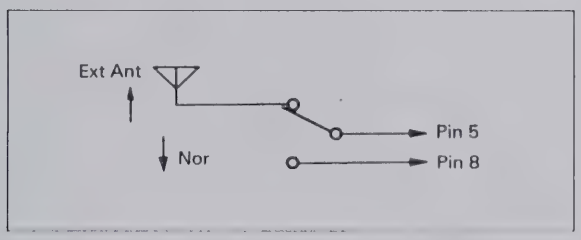
■ OPERATION WITH A SECOND RECEIVER

If you prefer operating another receiver in place of the TS-940S receiver section, you may share the antenna from the TS-940S during receive-time. Flip the rear panel RX-ANT switch to EXTERNAL, and connect the antenna input of your second receiver to the RX ANT terminal using 50Ω coaxial cable. Reduce the AF Gain setting on the transceiver to zero. Mute the external receiver from Pin 4 and GROUND of the remote connector. If a linear amplifier is also used with the transceiver, diode isolate the external receiver and linear to Pin 4, and be sure combined current is less than the maximum rating for this terminal.

■ OPERATION WITH A SEPARATE RECEIVER ANTENNA

Use the XVRTR port and an 8 Pin DIN Plug, Part E07-0851-05

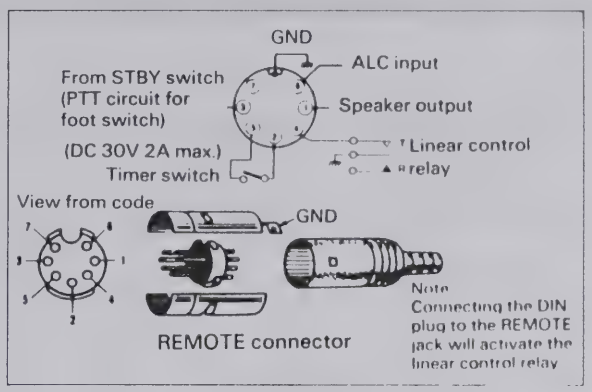
Pin 8 HF Ant output from the TS-940S
Pin 5 RX Ant input
Pin 3 GND



Either wire your extra antenna to pin 5 and ground, and use the DIN plug as the connect/disconnect, or wire pins 8 and 5 and the external antenna through a SPDT switch, as shown.

■ OPERATION AS A SECOND RECEIVER

Use the REMOTE Connector. Connect Pin 3 (PTT line) (and Pin 2, GROUND) to your XMTR control output, to ground Pin 3 in TX. Feed the antenna through the primary transmitter or transceiver antenna relay.



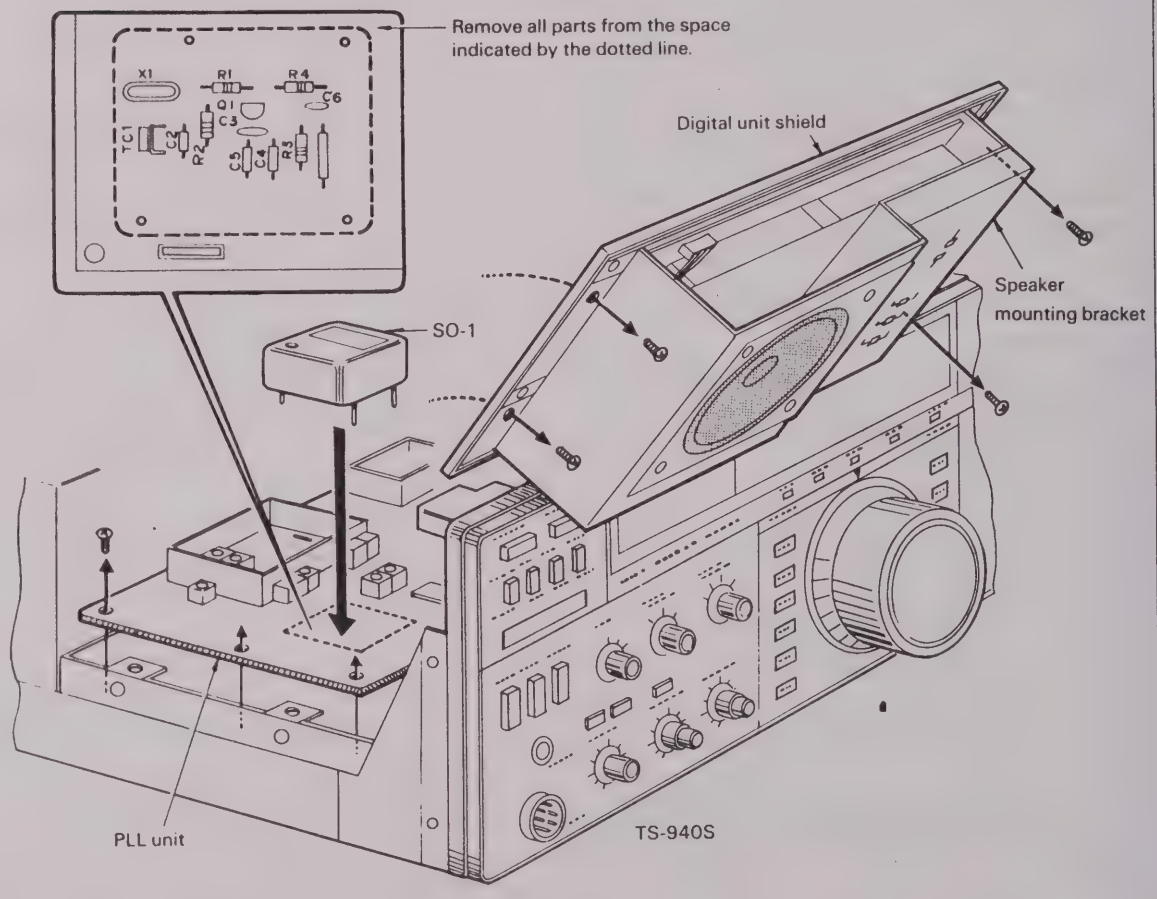
SPECIFICATIONS

Oscillating frequency ..... 20 MHz
Frequency stability ..... $\pm \times 10^{-6}$/year
(long term)
Temperature stability ..... $\pm \times 10^{-7}$
(–10°C +50°C)

Adjustable frequency
Range ..... more than ±60 Hz

Output ..... More than 0 dBm at 50 ohms
Weight 25g

Note:
Warranty registration is not required for the SO-1. Retain your sales slip or other proof of purchase, should service be required.



SO-1 Installation

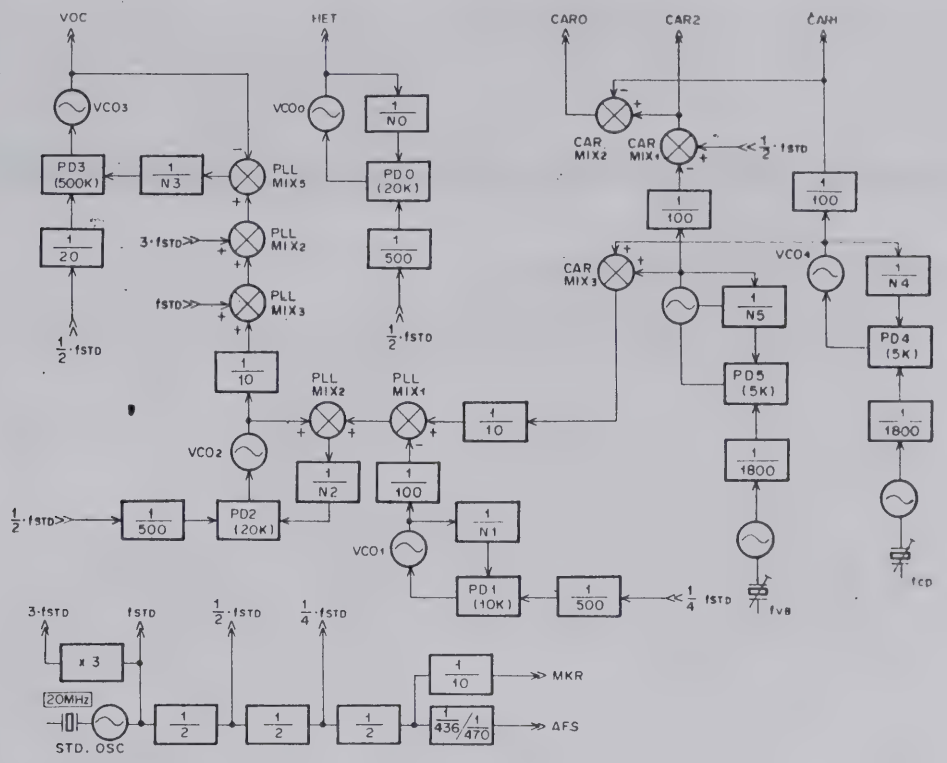


Fig. 10-2

gital unit A via the keyboard.

The received signal, having passed through the second IF filter, is applied to the third receiver mixer Q7, 8 to be mixed with the CAR2 signal (9.285 MHz) and then converted to the third IF signal (455 kHz). The output is then separated into two channels. One is connected to the Control unit FIN terminal, and goes through IF amplifier Q45 and third IF filter CF1 . It is then applied to limiter amplifiers IC11 and IC12 for amplitude limiting, and the output applied to ceramic discriminators L12 for FM detection. The detected output is supplied from the FMV terminal to the IF unit for the FM mode signal via the de-emphasis circuit and, at the same time, the noise component near 40 kHz is eliminated. The signal is then connected to the squelch circuit, noise amplifier Q46 and Q47, noise rectifier D80 and D81 and the comparator consisting of IC13 2/2.

The above Control unit circuits function in all modes. Therefore, one noise squelch system is employed. The squelch control output mutes the IF unit audio amplifier via the MTU terminal. (IF unit Q28)

The third IF signal is amplified by Q10 on the IF unit and is then applied to the filter circuit as the third IF signal.

This filter circuit uses a ceramic filter CF1 with a 2.7 kHz bandwidth for SSB (used also for wide CW/FSK and narrow AM) and ceramic filter CF2 with a 6 kHz bandwidth for AM wide. As an option, the filter circuit provides for use of either a CW 500 Hz crystal filter or 250 Hz bandwidth filter. These three filter types are automatically selected by information from Digital unit A, like the second IF filters. The signal from the third IF filter is amplified by Q1 and applied to the fourth receiver mixer to be mixed with the 355 kHz (CAR1 – CAR3) signal and converted to the fourth IF signal. The output is applied to Q13 via the notch filter circuit. This amplifier output is detected by either the SSB/CW product detector or the AM detector. The detected signal is applied to AF GAIN control via the squelch gate Q28 and preamplifier Q29. In CW mode, it is also possible to apply the signal through the AF TUNE circuit, IC1 and IC2. The output of Q3 is also applied to the AGC circuit. The received AF signal from the AF GAIN control is applied to the Control unit, where it is amplified by the audio power amplifier IC15 and used to drive the speaker.

10. CIRCUIT DESCRIPTION

10-1. FREQUENCY CONFIGURATION

The TS-940 is quadruple conversion in SSB, CW, AM and FSK modes and triple conversion in FM mode. As a transmitter, it is double conversion in CW and FM modes and triple conversion in SSB, AM and FSK modes.
Fig. 10-1 shows the frequency configuration of the signal paths as both a transmitter and a receiver.

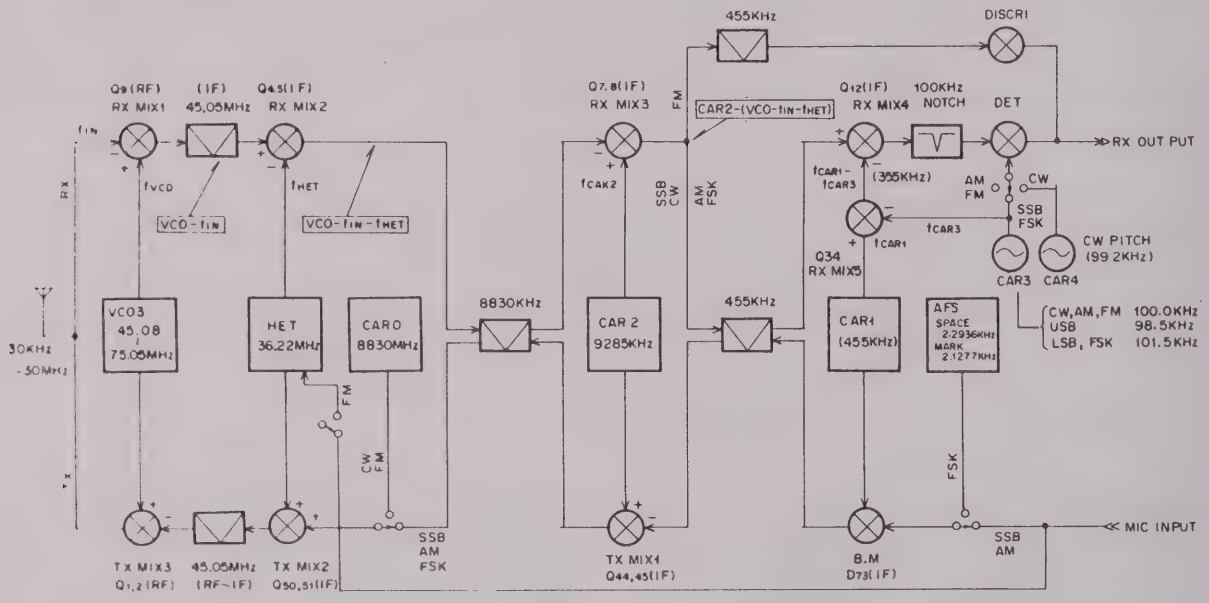


Fig. 10-1

10-2. LOCAL OSCILLATOR PLL CIRCUIT

This is a digital VFO (Variable Frequency Oscillator) that covers a frequency range of 45.08 MHz – 75.05 MHz in 10Hz steps. Three PLL loops are linked in analog mode. The dividing ratio data to each PLL is controlled by the microprocessor.
Each loop is of a single crystal frequency control system: the VCO phase is compared with the unique reference frequency STD . CAR1 and CAR2 frequencies are inserted halfway in the analog link, enabling variable bandwidth functions such as VBT and slope tuning.
The PLL circuit is shown in Fig. 10-2.

10-3. RECEIVER

The signal from the antenna is applied to the RF unit (X44-1660-00) ANT terminal. The signal passes through the transmitter/receiver selector circuit and out the EXT terminal. The output is connected to the RF unit RXA terminal via the selector circuit provided on the rear panel. This signal is applied to the receiver BPF through the RF attenuator (0, 10, 20, or 30dB selectable) via relays RL1 and RL2. The BPF divides the received frequency range into nine bands, which are automatically selected by RX BPF control data (RB0 – RB3) from the Digital unit A (X54-1830-00).

The signal from the BPF is passed through the RF AGC circuit composed of PIN diodes D23 and D26. It is then amplified by RF amplifier Q10 and applied to the first receiver mixer Q9, where it is mixed with the VCO signal to become the first IF signal at 45.05 MHz. This signal is applied to grounded gate amplifiers Q7 and 8, and the output is applied from the RIF terminal to IF unit (X48-1430-00).
The unwanted signal components are removed from the 45.05 MHz first IF signal by 15 kHz MCF XF1. The signal is then applied to the second receiver mixers Q4 and Q5, mixed with the (36.22 MHz) HET signal and converted to the (8.83 MHz) second IF signal. This signal is separated into two channels: one is supplied to the noise blanker on the Control unit (X53-1420-XX), and the other is applied to the second IF filter via noise blanking gate D3 – D6.
This filter circuit is provided with crystal filter XF2: YK88S1 with a 2.7 kHz bandwidth for SSB (used also for wide CW/FSK and narrow AM), and wide band LC filters L37, L38 for FM (used also for wide AM when the optional AM filter is not provided.) As an option, the filter circuit permits use of two filters: a YK-88C-1 with 500Hz bandwidth for CW and a YK-88A-1 with 6kHz bandwidth for AM. These four filters are automatically selected by the W/N-mode information (WN, ND2 and MD1) from Di-

11. MAINTENANCE AND ADJUSTMENT

GENERAL

Your transceiver has been factory aligned and tested to specification before shipment. Under normal circumstances the transceiver will operate in accordance with these operating instructions. All adjustable trimmers and coils in your transceiver were preset at the factory and should only be readjusted by a qualified technician with proper test equipment.
Attempting service or alignment without factory authorization can void the transceivers warranty.

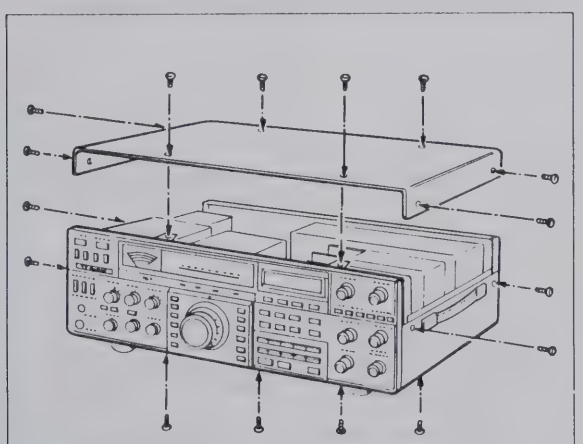
When operated properly, the transceiver should give years of service without requiring realignment. The information in this section gives some general service procedures which can be accomplished without sophisticated test equipment.

CLEANING

The knobs, front panel and cabinet of the transceiver are likely to become soiled after extended use. The knobs should be removed from the transceiver and cleaned with a neutral soap and warm water. Use a neutral soap (not harsh chemicals) and damp cloth to clean the cabinet and front panel.

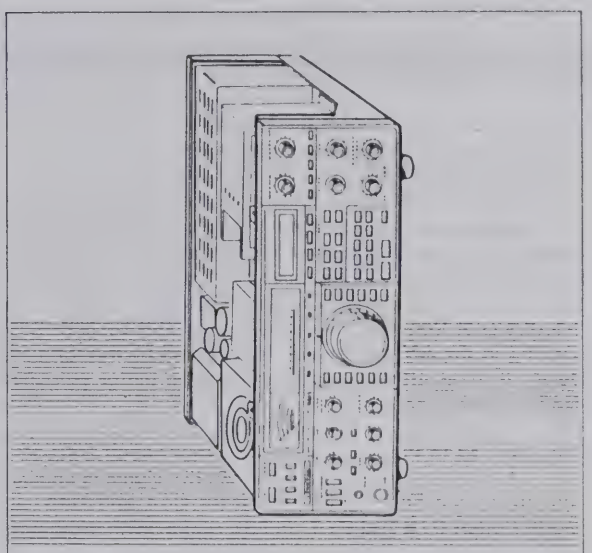
11-1. PREPARATION

1. Removing the covers
Remove the eight screws which fasten the top and eight screws from the bottom case panel. The covers may be lifted away.



Removing cases

2. Service position
Place the transceiver on its left side, with the final stage up, for proper ventilation.



Service position

11-2. ADJUSTMENTS

1. RV voltage adjustment (Control unit)
Adjust the voltage to 2.1V with VR-1.

2. Supply voltage adjustment (Power Supply unit)
Adjust the voltage to 28.5V with VR-1.

3. Digital display calibration
Connect the antenna, place the MODE switch to CW, and Zero-Beat to WWV at either 5, 10 or 15 MHz. Next, turn the 100 kHz calibrator ON and the marker signal will be superimposed on the WWV signal. If the calibrator is also at Zero-Beat, adjustment is not necessary.
If the calibrator is not Zero-Beat with WWV, adjust the Standard oscillator trimmer through the reference frequency adjustment access opening (on the side of the TS-940S) so the two signals are again Zero-Beat. Repeat this procedure 2 or 3 times. This completes calibration of the Digital Display. After calibration turn off the CAL switch.

Note:
WWV is not a reliable signal in Europe.

4. Sub-display contrast adjustment
If necessary, adjust the SUB DISP. CONTRAST control on the top panel at the normal viewing position in order to retain LCD contrast.

10-4. TRANSMITTER

The audio signal from the microphone is applied to the IF unit MIC terminal and is preamplified by Q36. The output is applied to the MIC GAIN control (on the front panel), the FM MIC GAIN control (on the top panel) or VOX circuit in the SSB and AM modes. The SSB signal channel is returned to the IF unit, amplified by IC3 and applied to balanced modulator D73. A diode switch is provided at the input of IC3, which selects the audio signal in the SSB and AM mode, and the AFSK signal (2.2936 kHz/2.1277 kHz) from the PLL unit in the FSK mode. Balanced modulator D73 is constructed as a package containing four matched Schottky diodes, which provides stable modulation characteristic against varying operating conditions such as temperature fluctuation. The 455 kHz DSB (Double Side Band) signal from D73 is converted to SSB by filter CF1 (or CF2 in the AM mode), which is shared by the third receiver IF filter after passing through the buffer amplifier Q37.

The filter output runs through buffer amplifier Q39 and is then applied to the RF speech processor circuit Q40, IC4 and Q43. When the processor is off, the signal is applied directly to the first transmitter mixer Q44 and Q45 via diode switch D78 and D79. In FSK mode, even if the processor switch is off, approx. 10dB compression is automatically applied. This effectively suppresses any level difference between MARK and SPACE frequencies in AFSK. Note, however, that the compression meter does not deflect.

In the AM mode, even if the processor switch is off, the signal runs through D78 and D79 but does not pass through the processor. The processor output signal is applied to the first transmitter mixer via diode switch D83. Here, the audio signal is mixed with the CAR2 signal (9.285 MHz) and converted to 8.83 MHz. The 8.83 MHz signal runs through SSB filter XF2 (a wide band filter L37, L38 or optional YK-88A-1 in AM mode) shared by the second receiver IF filter, where any splatter which may be generated in the speech processor is eliminated.

The signal is then applied to the transmitter IF amplifier Q48. In CW and FM modes or during auto antenna tuning, the CAR0 signal is applied to Q48 via buffer amplifier Q46. In these modes, since the transmitter signal does not pass through the narrow band filter, full CW break-in operation is enabled.

The transmitter signal is then applied to the second transmitter mixer Q50 and Q51, where it is mixed with the HET signal (36.22 MHz), yielding a TIF signal at 45.05 MHz, whose output is connected to the RF unit. In the RF unit, the signal is mixed with the VCO signal in the third transmitter mixer Q1 and Q2, providing the final transmitter frequency.

Any undesirable components in this signal are then eliminated in the transmitter BPF (1.8 – 30 MHz). The signal is amplified by wideband amplifier Q3, Q4 and Q5 and supplied from the DRV terminal to the Final unit as the drive-level output. This drive output is automatically disconnected from the Final unit input if a plug is inserted into the transverter connector. The signal applied to the Final unit is amplified by wideband drivers Q2, Q3 and finals Q4, Q5.

The output of the Final unit passes through the Filter unit where the unwanted higher harmonic component elements are eliminated. The Filter unit divides the transmitter frequency range into bands. Each LPF is automatically selected by TX LPF information (LP0-LP2) supplied from Digital unit A.

After passing through the Filter unit, the transmitter output runs through the AT (optional) unit, the transmitter/receiver selector circuit and then is connected to the ANT terminal on the rear panel.

10-5. AUTO ANTENNA TUNER

The auto antenna tuner consists of the tuner section and the control section.

The tuner section consists of coils and variable capacitors which form the matching circuit. The variable capacitors are driven by high speed motors.

The control section decodes the matching condition of the transmitter output stage and drives and controls the motors to make a good match between the transmitter and the antenna.

This auto antenna tuner works within the amateur bands (1.8 MHz ~ 29.7 MHz).

6. AC voltage selection

The TS-940S will operate on 120, 220 or 240V AC 50 or 60 Hz. For proper operation, select the power setting closest to your local line voltage.

If you are not sure of the local line voltage, contact the utility company. To reset the voltage selector, FIRST DISCONNECT THE POWER CABLE. Use a screwdriver align the selector to the correct voltage.

7. Ordering spare parts

When ordering replacement or spare parts for your equipment, be sure to specify the following information: Model and serial number of the equipment. Schematic number of the part. Printed circuit board number on which the part is located. Part number and name, if known, and quantity desired.

8. Service

Should it ever become necessary to return the equipment for repair, pack in its original boxes and packing, and include a full description of the problems involved. Also include your telephone number. You need not return accessory items unless directly related to the service problem.

You must return your radio for service to the Authorized TRIO Dealer from whom you purchased it. A copy of the service report will be returned with the unit. Please do not send sub-assemblies or printed circuit boards. Send the complete unit, in its original boxes and packing.

Service note:

Dear OM, if you desire to correspond on a technical or operational problem, please make your note short, complete, and to the point. And PLEASE make it readable.

Please list: Model and serial number.

The question or problem you are having

Please give sufficient detail to diagnose: other equipment in the station, meter readings and anything you feel might be useful in attempting diagnosis.

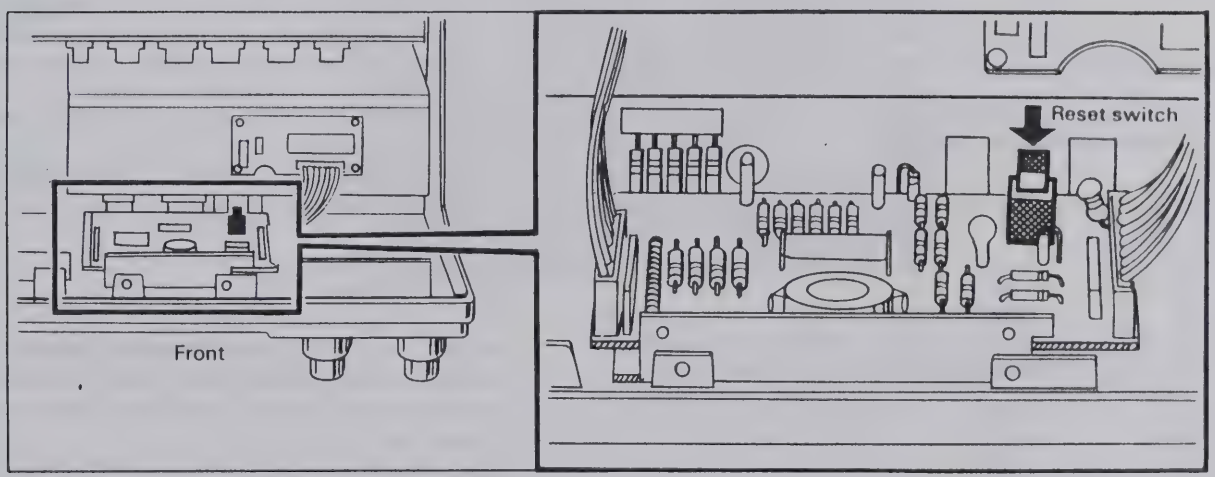
Note:

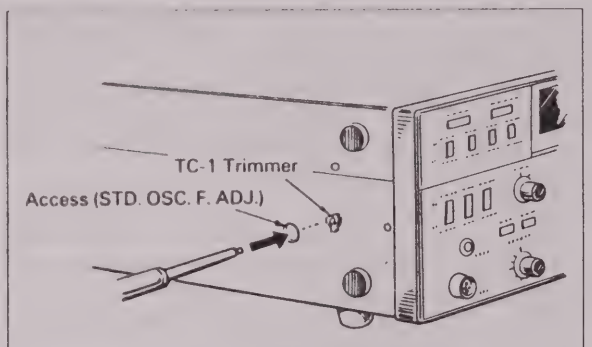
1. Record the date of purchase, serial number and dealer from whom purchased.
2. For your own information, retain a written record of any maintenance performed on the unit.
3. When claiming warranty service, you must include a photocopy of the bill of sale, or other proof of purchase showing the date of sale.

11-4. HOW TO INITIALIZE MICROPROCESSOR

1. If the microprocessor malfunctions or if you want to reset the transceiver, switch on the power with the A = B switch pressed.
2. If the sub-display fails to perform properly, press the reset switch (see the figure) at the rear of the sub-display to reset the sub-display. After this, always switch off the transceiver source power and then switch on again.

NOTE: If the POWER switch is operated too frequently, the sub-display may fail to indicate properly. In this case, switch off the source power and then switch on again.





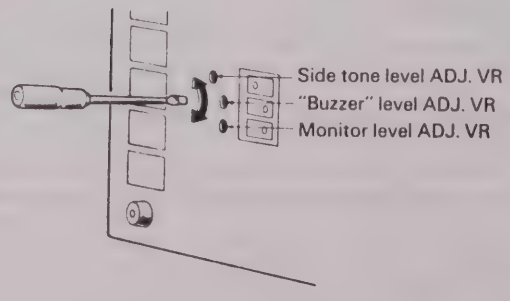
Digital display calibration

5. Carrier balance adjustment (IF unit)
With a 50Ω dummy load connected to the ANT terminal, adjust for maximum output at 14.175 MHz. Reduce mic gain to zero. Set the transceiver in LSB mode. The power meter or an oscilloscope will deflect if the carrier is unbalanced. To balance the carrier, alternately adjust trimmer TC1 and trimpot VR-6 until the meter indicates minimum.
Switch to USB mode and if the pointer deflects, readjust so the pointer deflects equally for both LSB and USB

6. Side tone level adjustment (Control unit)
Adjust VR-15 for your preference.

7. "Buzzer" level adjustment (Control unit)
Adjust VR-14 for your preference.

8. Monitor level adjustment (Control unit)
Adjust VR-13 for your preference.



Adjustment points on bottom cover

9. S meter adjustment (IF unit)
Disconnect the antenna with the transceiver in receive mode. Zero-point adjustment:
Adjust VR-3 for meter pointer zero indication. If a standard signal generator (SSG) is available, adjust VR-4 so the S-meter indicates "S-9", at 14.175 MHz for a 40 dB (50 μV) signal.

10. NOTCH adjustment (IF unit)
Turn the CAL (marker) switch on and tune for 800 Hz in the CW mode.
Place the MODE switch to CW and turn the NOTCH switch on.
Adjust the NOTCH control to the 12 o'clock position and fine tune NOTCH for the notch point.
Adjust VR-2 and L-16 for minimum audio output. Repeat the NOTCH control and L-16 adjustments several times for best null.

11-3. MAINTENANCE

1. Semiconductors, resistors, and capacitors
Semiconductors are easily destroyed if a circuit is shorted. Troubleshoot carefully.
If a defective resistor or capacitor is to be replaced, use one of the same specifications.

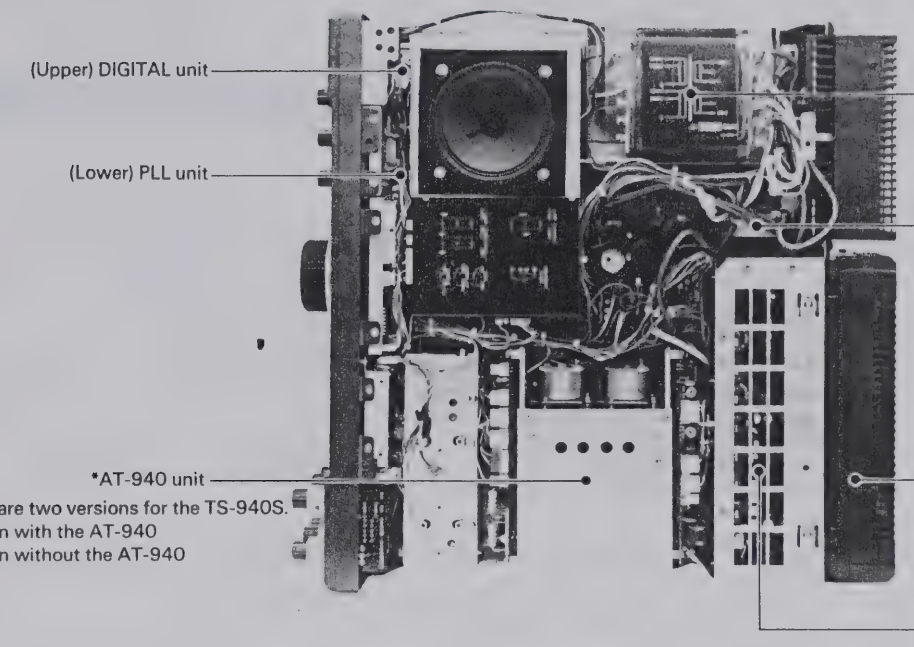
2. Fuse
When the fuse blows, there is some cause. Be sure to find the cause before attempting operation. Use a 6 A fuse for 120VAC, or a 4 A fuse for 220V AC ~ 240 VAC operation. Under no circumstances use a higher amperage fuse than specified. This can cause extensive damage. The warranty will be void if an oversized fuse is used.

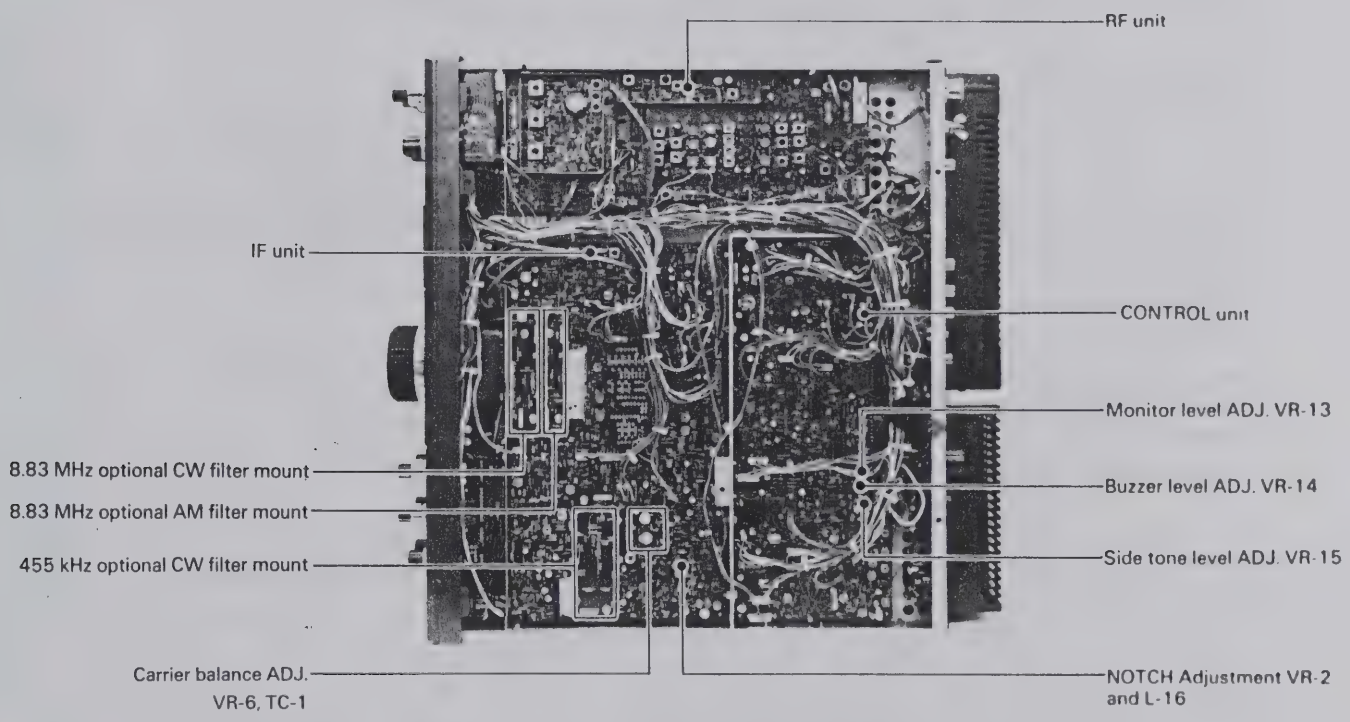
3. Fan motor lubrication
Every 6 months apply a drop of light machine oil at the point where the shaft meets the motor housing.

4. Meter lamp Replacement
1. Remove power cable.
2. Remove 8 screws and top cover.
3. Slide the two METER meter lamps (with grommets) from their keyed slots on the rear of the METER shield.
4. Desolder the leads from the circuit board adjacent to the power switch.
5. Replace the lamps in reverse order of disassembly.
   Meter lamp part number is B30-0817-15. These are rated 14V, 80 mA.

5. Back-up Battery
The TS-940S has two back-up batteries. One for memory back-up (5 years); the other for the timer (3 years).

13. INTERNAL VIEWS





12. IN CASE OF DIFFICULTY ...

TRANSMITTER SECTION

SYMPTOM	CAUSE	REMEDY
No output in SSB (No Ic.)	1. Open microphone cable or bad microphone. 2. Low microphone gain. 3. PROC switch is to ON with PROC IN/OUT control fully counterclockwise.	1. Check the microphone. 2. Increase the mic Gain. 3. Increase the PROC IN/OUT settings.
VOX does not operate.	1. VOX GAIN control too low. 2. ANTI VOX control requires adjustment.	1. See section 5-11 VOX operation. 2. See section 5-11 VOX operation.
VOX trips by speaker output.	ANTI VOX control requires adjustment.	See section 5-11 VOX operation.
Mic or radio chassis is "hot" during TX.	Excess RF in the shack. No earth ground, poor ground, or antenna is too close to the radio.	See section 1-6.
Poor audio in SSB, TX-feedback.	Excess RF in the shack.	See section 5-13.

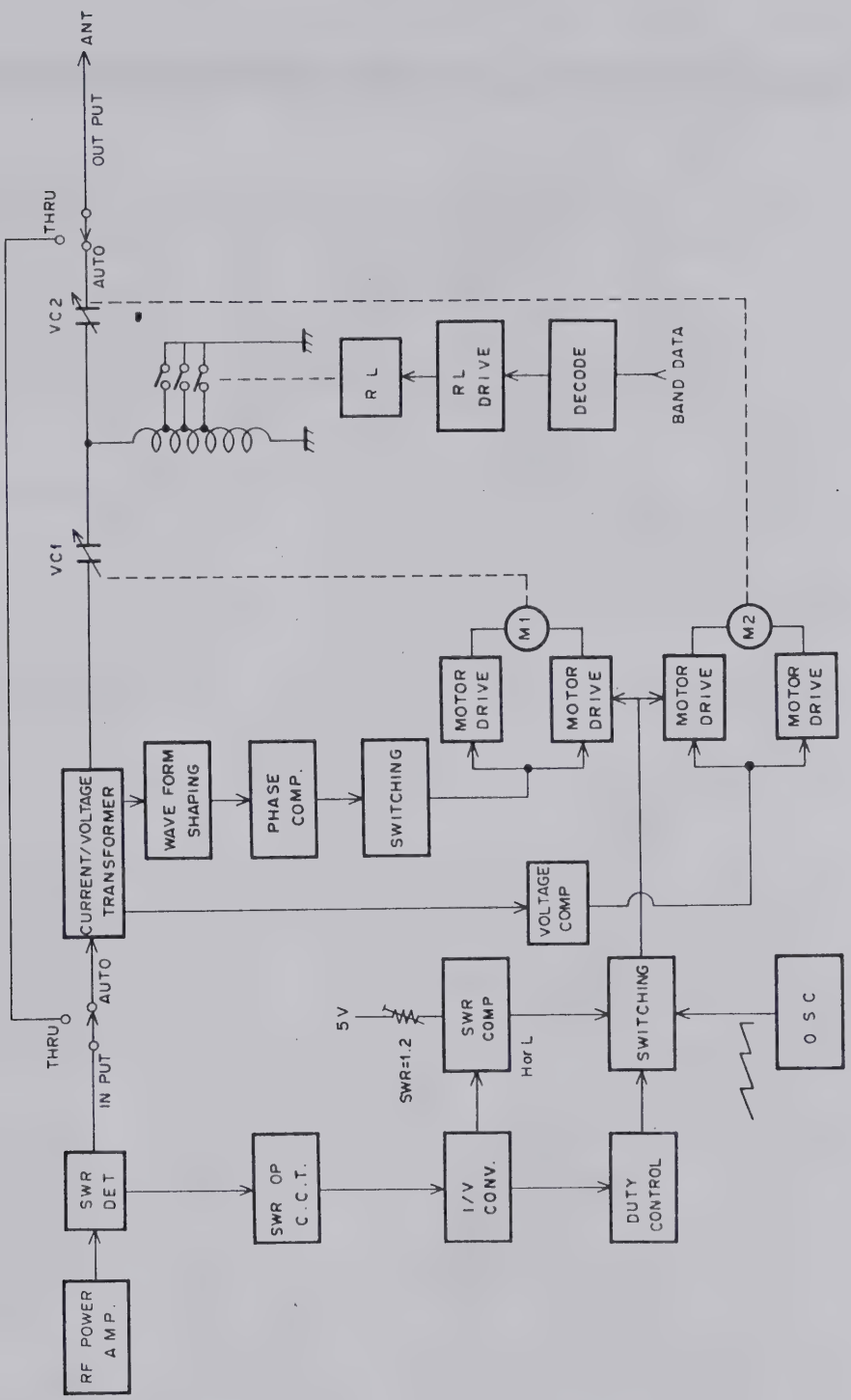
RECEIVER SECTION

SYMPTOM	CAUSE	REMEDY
Lights do not light and there is no receiver noise when the POWER switch is turned on.	1. Bad power cable or connections. 2. Blown power supply fuse.	1. Check cables and connections. 2. Check for the cause of the blown fuse and replace the fuse.
An antenna is connected but no signals are heard.	Microphone PTT switch (or stand-by switch) is in the transmit position.	Release the PTT switch.
An antenna is connected but S-meter deflects without a received signal.	1. RF GAIN control fully anticlock use. 2. Low AC line voltage.	1. Open RF GAIN control. 2. Use a step-up transformer to raise the line voltage.
SSB signal unintelligible.	MODE switch is set to wrong sideband.	Turn MODE switch to the correct sideband.
RIT control inoperative.	RIT switch is off.	Push RIT button.
SSB received signal is extremely high cut or low cut.	Slope tuning is out of adjustment.	Set to the NORMAL position.

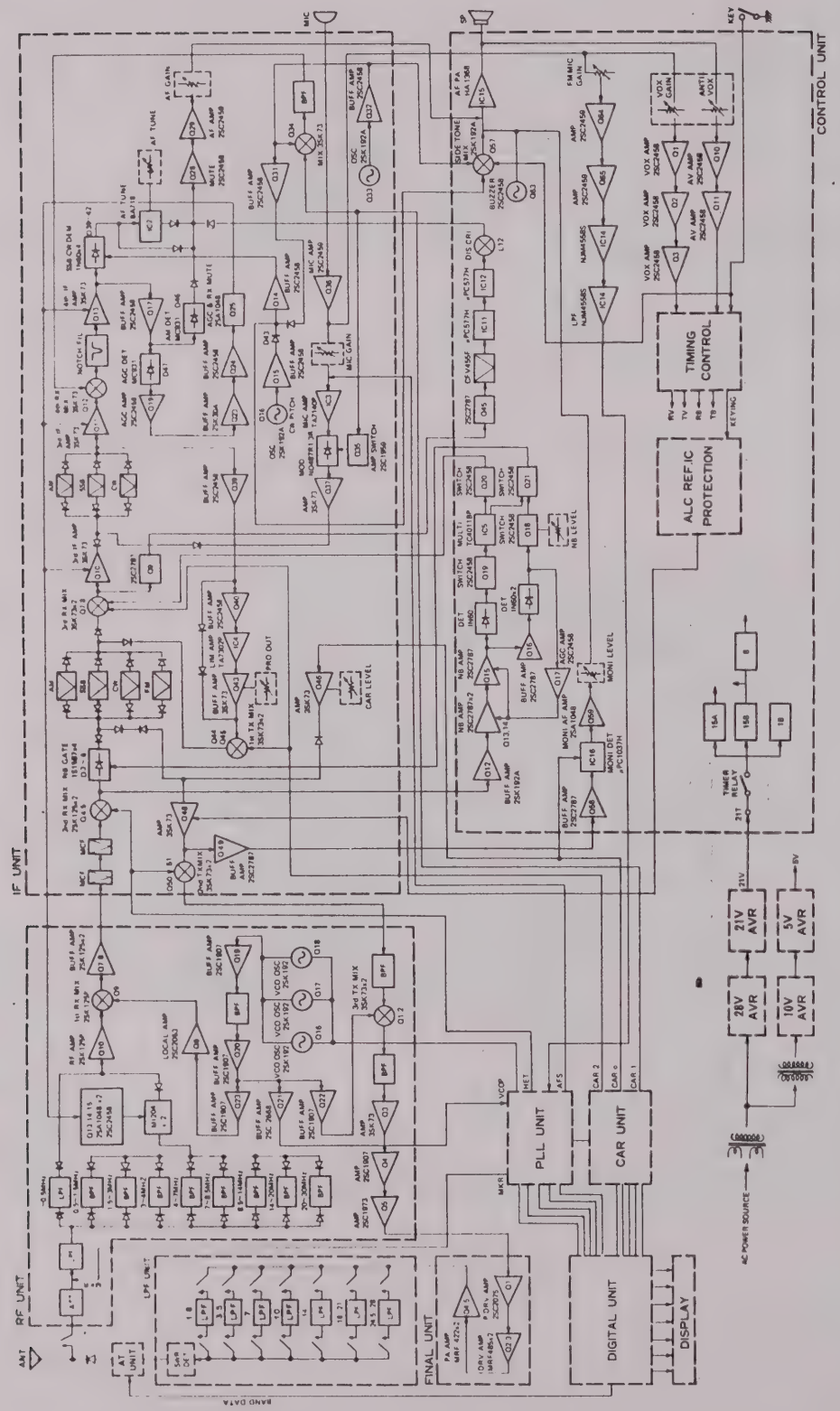
TIMER SECTION

SYMPTOM	CAUSE	REMEDY
Transceiver not turned on.	TIMER switch on with repeat timer set.	Set the TIMER switch to off.

ANTENNA TUNER AT-940



14. BLOCK DIAGRAMS



15. SPECIFICATIONS

[GENERAL]

Transmitter Frequency Range:	160 m Band 1.8 ~ 2.0 MHz 80 m Band 3.5 ~ 4.0 MHz 40 m Band 7.0 ~ 7.3 MHz 30 m Band 10.1 ~ 10.15 MHz 20 m Band 14.0 ~ 14.35 MHz 17 m Band 18.068 ~ 18.168 MHz 15 m Band 21.0 ~ 21.45 MHz 12 m Band 24.89 ~ 24.99 MHz 10 m Band 28.0 ~ 29.7 MHz
Receiver Frequency Range:	150 kHz ~ 30 MHz
Mode:	A3J (USB, LSB), A1 (CW), F1 (FSK), A3 (AM), F3 (FM)
Frequency Stability	$\pm 10 \times 10^{-6}$ (–10°C ~ +50°C)
Frequency Accuracy	$\pm 10 \times 10^{-6}$(Room temperature)
Antenna Impedance	50 ohms
With AT-940 Antenna Tuner	20 ~ 150 ohms (Transmission only)
Power Requirement:	120/220/240 VAC, 50/60 Hz
Power Dissipation:	Max. 510 W during transmission, 80 W during reception
Dimensions	W 401 × H 141 × D 350 mm (Projections Inc.) W 409 × H 154 × D 420 mm W 160.4 × H 56.4 × D 140 inch (Projections Inc.) W 163.6 × H 61.6 × D 168 inch
Weight	With antenna tuner: Approx. 20 kg (44.0 lbs) Without antenna tuner: Approx. 18.5 kg (41.0 lbs)

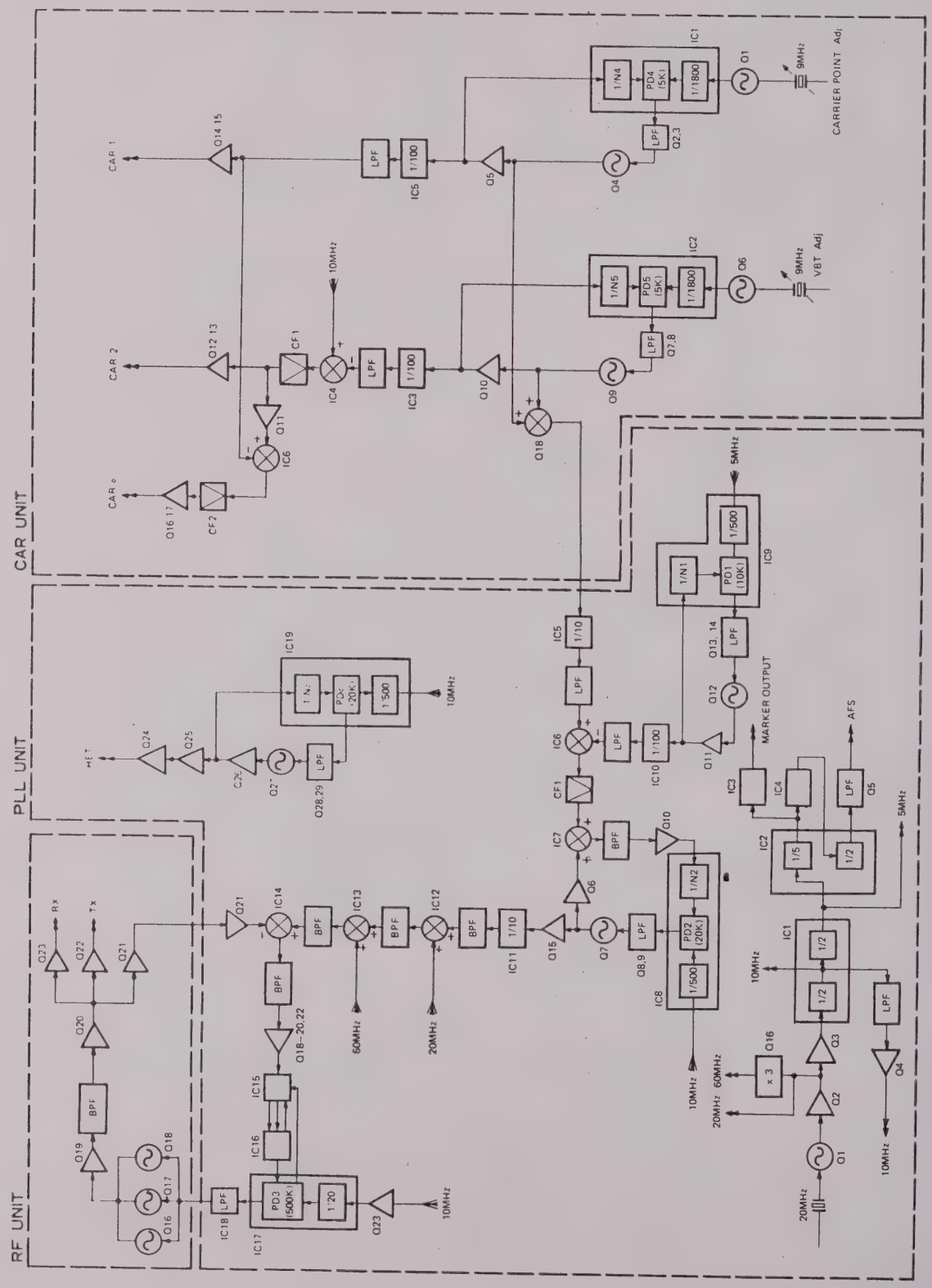
[TRANSMITTER]

Rated Final Power Input	250W PEP (160 ~ 10 m bands in SSB, CW, FSK, FM) 140W (in AM)
Modulation	SSB: Balanced modulation FM: Reactance modulation AM: Low level modulation
Maximum Frequency Deviation	± 5 kHz
RTTY Shift	170 Hz
Harmonic Content	–40 dB or less (in CW)
Carrier Suppression	40 dB or more (with 1.5 kHz modulation)
Unwanted Sideband Suppression	Better than 50 dB (with 1.5 kHz modulation)
3rd order intermodulation	–37 dB or less (based on Single tone output)
Microphone Impedance	500Ω ~ 50kΩ
Frequency Response	400 ~ 2600 Hz at –6 dB in SSB

[RECEIVER]

Circuitry	Quadruple conversion for SSB, CW, AM, FSK Triple conversion for FM
Intermediate Frequencies	1st IF: 45.05 MHz 2nd IF: 8.83 MHz 3rd IF: 455 kHz 4th IF: 100 kHz

(PLL · CAR UNIT)


CAR UNIT
PLL UNIT
RF UNIT
CARRIER POINT Adj
VBT Adj
MARKER OUTPUT
AFS
9MHz
5MHz
10MHz
60MHz
20MHz
CAR 1
CAR 2
CAR 0
HET
Rx
Tx
LPF
BPF
1/N4
PD4 (5K)
1/1800
1/N5
PD5 (5K)
1/N1
PD1 (10K)
1/500
PD2 (20K)
1/N2
PD3 (500K)
1/20
1/100
1/10
1/5
1/2
× 3
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12
IC13
IC14
IC15
IC16
IC17
IC18
IC19
CF1
CF2
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8,9
Q10
Q11
Q12
Q13, 14
Q15
Q16
Q16 17
Q18
Q18–20,22
Q19
Q20
Q21
Q22
Q23
Q24
Q25
Q26
Q27
Q28,29
Q2,3
Q7,8
Q12 13
Q14 15

Sensitivity	
150 kHz ~ 500 kHz	10 dB S/N 0 dBμ (1μV) or less in SSB, CW and FSK
	10 dB S/N 20 dBμ (10μV) or less in AM
500 kHz ~ 1.8 MHz	10 dB S/N 12 dBμ (4μV) or less in SSB, CW and FSK
	10 dB S/N 30 dBμ (32μV) or less in FM
1.8 MHz 30 MHz	10 dB S/N –14 dBμ (0.2μV) or less in SSB, CW and FSK
	10 dB S/N 6 dBμ (2μV) or less in AM
	12 dB SINAD –6 dBμ (0.5μ) or less in FM
Squelch Sensitivity	–10 dBμ (0.32μV) or less
Image Ratio	80 dB or more in 1.8 – 30 MHz
IF Rejection	70 dB or more in 1.8 – 30 MHz
Selectivity:	
N: Denotes the filter setting is NARROW.	
W: Denotes the filter setting is WIDE.	
(SSB, CW, AM(N), FSK)	2.4 kHz/–6 dB
	3.6 kHz/–60 dB
(AM (W))	6 kHz/–6 dB
	15 kHz/–50 dB
(FM)	12 kHz/–6 dB
	22 kHz/–60 dB
Variable Range	With SSB Filter
(SSB Slope Tune)	High-cut: 1500 Hz or more
	Low-cut: 700 Hz or more
	Without SSB filter
(CW VBT)	600 Hz ~ 2.4 kHz continuously variable
RIT/XIT Variable range	±9.99 kHz
Notch Filter Antenuation	40 dB or more
Audio Output	1.5 W (at 8 ohm load/10% distortion)
Audio Load Impedance	8 ohms

Note: Circuits and ratings subject to change without notice due to developments in technology.

Model TS-940S

Serial No.

Date of Purchase

Dealer _____

KENWOOD CORPORATION

Shionogi Shibuya Building, 17-5, 2-chome Shibuya, Shibuya-ku, Tokyo 150, Japan

TRIO-KENWOOD COMMUNICATIONS
Post Office Box 7065, Compton,California 90224,U.S.A.

KENWOOD COMMUNICATIONS
DIVISION OF KENWOOD ELECTRONICS DEUTSCHLAND GMBH
Rembrücker Str. 15, 6056 Heusenstamm, West Germany

KENWOOD ELECTRONICS BENELUX N.V.
Leuvensesteenweg 504, B-1930 Zaventem, Belgium

KENWOOD ELECTRONICS AUSTRALIA PTY. LTD.
4E. Woodcock Place, Lane Cove, N.S.W. 2066, Australia

②③④⑤⑥⑦⑧⑨

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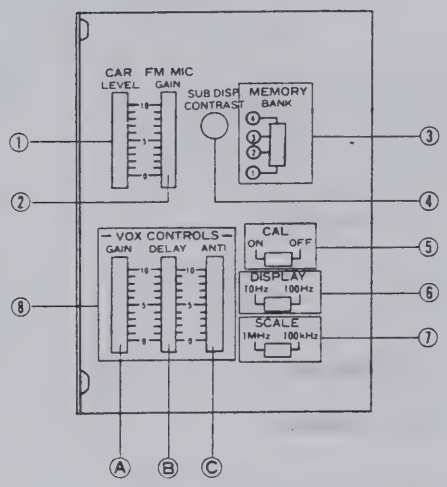
2. CONTROLS, INDICATORS AND CONNECTORS

TOP COVER

Slide lid opened



① **CAR LEVEL (carrier level) control**
Used to adjust carrier level during CW

② **FM MIC GAIN (microphone gain) c**
Used to adjust microphone amplifier g

③ **Memory group selector switch**
Allows to selection of the desired group.

④ **SUB DISP. CONTRAST control**
Allows you to adjust the contrast of t ing a (–) screwdriver.

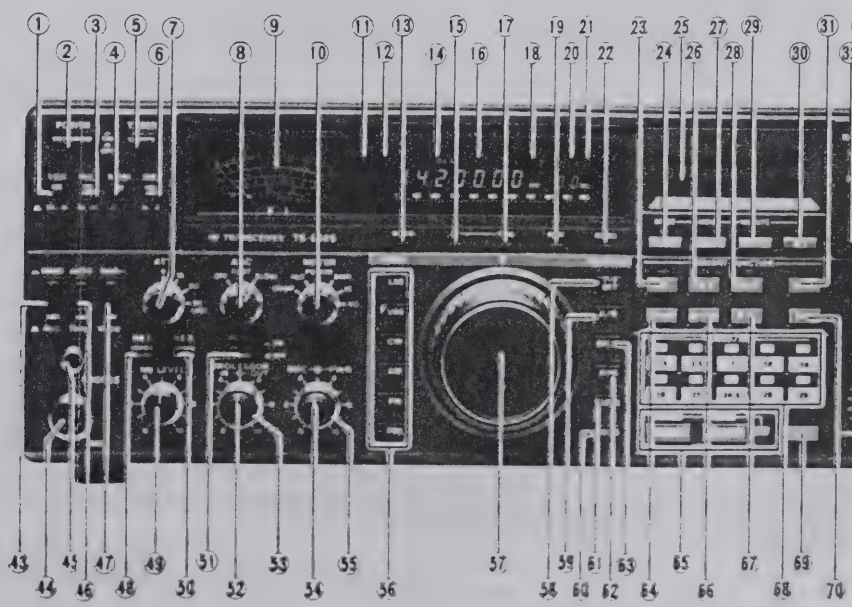
⑤ **CAL (marker) switch**
When this switch is ON durin built-in oscillator will generate a ma kHz intervals. This switch is also use internal oscillator frequency with quency (WWV).

⑥ **10 Hz indication switch**
Allows frequency indication down to digit.

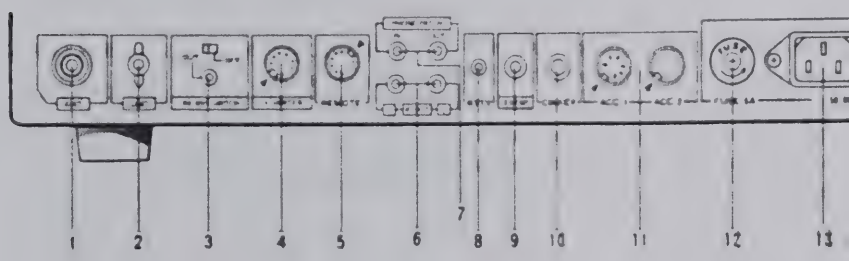
⑦ **Analog SCALE selection switch**
Used to select the analog scale 100 kHz.

⑧ **VOX control**
Ⓐ GAIN: Used to adjust VOX amplifi
Ⓑ DELAY: Used to adjust delay time
Ⓒ ANTI: Used so that VOX will not internal speaker sound.

FRONT PANEL



REAR PANEL



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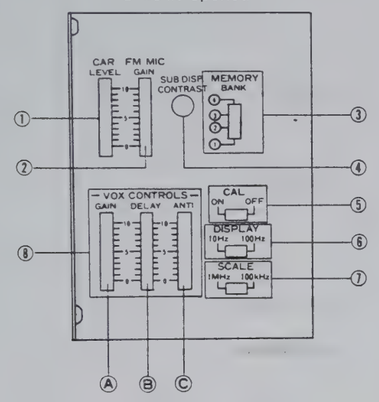
2. CONTROLS, INDICATORS AND CONNECTORS

TOP COVER

Slide lid opened



① **CAR LEVEL (carrier level) control**
Used to adjust carrier level during CW.

② **FM MIC GAIN (microphone gain) control**
Used to adjust microphone amplifier gain in FM.

③ **Memory group selector switch**
Allows to selection of the desired memory channel group.

④ **SUB DISP. CONTRAST control**
Allows you to adjust the contrast of the sub display, using a (–) screwdriver.

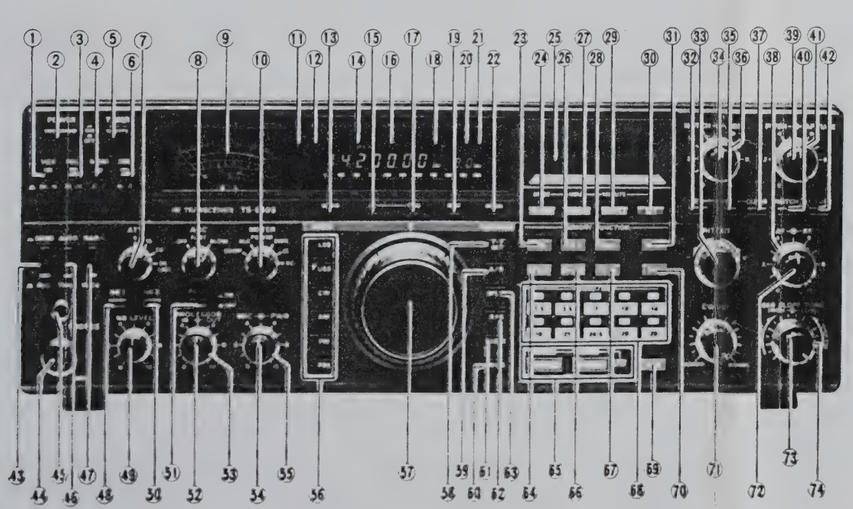
⑤ **CAL (marker) switch**
When this switch is ON during reception, the built-in oscillator will generate a marker signal at 100 kHz intervals. This switch is also used to zero beat the internal oscillator frequency with a standard frequency (WWV).

⑥ **10 Hz indication switch**
Allows frequency indication down to the nearest 10 Hz digit.

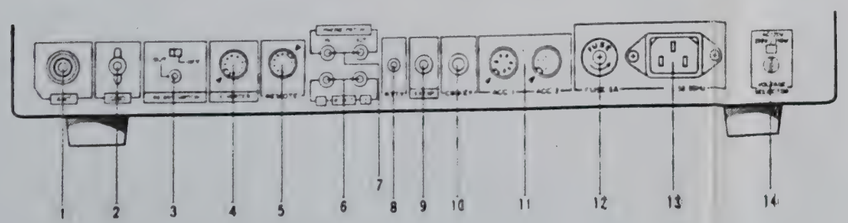
⑦ **Analog SCALE selection switch**
Used to select the analog scale range, 1 MHz or 100 kHz.

⑧ **VOX control**
Ⓐ GAIN: Used to adjust VOX amplifier gain.
Ⓑ DELAY: Used to adjust delay time.
Ⓒ ANTI: Used so that VOX will not be actuated by the internal speaker sound.

FRONT PANEL



REAR PANEL



FRONT PANEL

① **VOX switch** ⇨ page 24
② **POWER switch**
③ **CW break-in selector switch** ⇨ page 23
④ **MONI (monitor) switch** ⇨ pages 8,10, 14, 16
⑤ **TIMER switch** ⇨ page 38
⑥ **DIM (Dimmer) switch** ⇨ page 19
⑦ **ATT switch** ⇨ page 24
⑧ **AGC switch** ⇨ page 25
⑨ **Meter** ⇨ page 20
⑩ **METER switch** ⇨ page 20
⑪ **Main display**
⑫ **F. LOCK indicator** ⇨ page 19
⑬ **ON AIR indicator** ⇨ page 19
⑭ **VFO A indicator** ⇨ page 19
⑮,⑰ **ANT TUNE indicator** ⇨ page 19
⑯ **VFO B indicator** ⇨ page 19
⑱ **MEMO (Memory) channel indicator** ⇨ page 19
⑲ **SPLIT indicator** ⇨ page 19
⑳ **RIT indicator** ⇨ page 19
㉑ **XIT indicator** ⇨ page 19
㉒ **NOTCH indicator** ⇨ page 19
㉓ **MS (Memory scan) switch** ⇨ page 33
㉔ **CLOCK switch** ⇨ page 35
㉕ **Sub-display** ⇨ page 35
㉖ **PG. S (Program scan) switch** ⇨ page 33
㉗ **GRAPH switch** ⇨ pages 35, 36
㉘ **HOLD switch** ⇨ page 33
㉙ **SCROLL switch** ⇨ pages 34, 35
㉚ **SET switch** ⇨ page 35
㉛ **M. CE switch** ⇨ page 34
㉜ **RIT switch** ⇨ page 26
㉝ **RIT/XIT control** ⇨ page 26
㉞ **NOTCH control** ⇨ page 22
㉟ **XIT switch** ⇨ page 26
㊱ **SQL control** ⇨ pages 9, 13, 15, 17
㊲ **CLEAR switch** ⇨ page 26
㊳ **RF (gain) control** ⇨ page 25
㊴ **PITCH control** ⇨ page 26
㊵ **NOTCH switch** ⇨ page 22
㊶ **AF TUNE control** ⇨ page 26
㊷ **AF TUNE switch** ⇨ page 26
㊸ **REC/SEND stand-by switch** ⇨ pages 9, 11, 15, 17
㊹ **MIC (Microphone) connector** ⇨ pages 7, 29
㊺ **PHONES jack** ⇨ pages 7, 29
㊻ **AUTO-THRU selector switch** ⇨ page 18
㊼ **NAR/WIDE switch** ⇨ pages 10, 12
㊽ **NB 1 switch** ⇨ page 22
㊾ **NB control** ⇨ page 22
㊿ **NB 2 switch** ⇨ page 22
(51) **PROC switch** ⇨ page 24
(52) **PROCESSOR-IN control** ⇨ page 24
(53) **PROCESSOR-OUT control** ⇨ page 24
(54) **MIC (microphone gain) control** ⇨ pages 9, 15
(55) **PWR (RF power) control** ⇨ pages 8, 10, 14, 16
(56) **MODE switch** ⇨ pages 8 ~ 17
(57) **Main tuning control** ⇨ pages 8 ~ 17
(58) **T-F SET switch** ⇨ page 20
(59) **A/B switch** ⇨ page 19
(60) **VOICE switch** ⇨ page 19
(61) **F. LOCK switch** ⇨ page 19
(62) **A = B switch** ⇨ page 19
(63) **SPLIT switch** ⇨ page 19
(64) **VFO/M switch** ⇨ page 31
(65) **1 MHz step switch** ⇨ pages 8 ~ 17
(66) **M ▶ VFO switch** ⇨ page 33
(67) **M. IN switch** ⇨ page 31
(68) **BAND KEY (1 – 10) switch** ⇨ pages 8 ~ 17
(69) **AT. T switch** ⇨ page 18
(70) **ENT (Enter) switch** ⇨ page 34
(71) **VBT control** ⇨ page 21
(72) **AF (audio gain) control** ⇨ page 26
(73) **SSB SLOPE TUNE HIGH CUT control** ⇨ page 21
(74) **SSB SLOPE TUNE LOW CUT control** ⇨ page 21

REAR PANNEL

① **Antenna connector**
Connect an antenna with an impedance of 50 Ω, with an SWR of 1.5 or less.

② **GND (ground) terminal**
Used to make TS-940S ground. Connect using as thick and short a wire as possible.

③ **RX ANT terminal selector switch**
Used to disconnect the TS-940S receiver. Supplies an antenna connection to an external receiver.

④ **Transverter connector**
For details, see page 29.

⑤ **Remote connector**
This connector is used when a linear amplifier is used.

⑥ **IF OUT jack**
IF 1 is for connection to the SM-220 for Pan Display. (8.83 MHz)
IF 2 is for connection to the SM-220 for RX Modulation Display. (100 kHz)

⑦ **PHONE PATCH jacks**
The IN terminal is used for transmit audio from the phone patch (600 Ω).
The OUT terminal is used for received audio from the transceiver to the phone patch (600 Ω). These jacks can also be used for input to and from SSTV, or RTTY terminals.

⑧ **RTTY jack**
For connection to an RTTY interface unit. (direct keying)

⑨ **EXT SP (external speaker)**
This terminal is for an external speaker.

⑩ **CW KEY jack**
Used to connect the key during use of CW.

⑪ **Accessory terminals**

⑫ **Fuse Holder**

⑬ **AC power connector**
Connect the supplied power cord.

⑭ **VOLTAGE SELECTOR switch**
Used to select the correct line voltage.

1-5. ANTENNA

Any of the common antenna systems designed for use on the high frequency amateur bands may be used with the TS-940S, provided the input impedance of the transmission line is not outside the capability of the AT-940 Automatic Antenna Tuner pi-output matching network. The transmission line should be coaxial cable. An antenna system which shows a standing wave ratio of less than 1.5 : 1 when using 50 ohm coaxial transmission line, or a system that results in a transmission line input impedance that is essentially resistive, and between 20 and 150 ohms will take power from the transceiver through the AT-940. If open wire or balanced type transmission line is used with the antenna, a suitable antenna tuner with balun is recommended between the transceiver and the feed line. Methods of construction and operating such tuners are described in detail in the ARRL Antenna Handbook, or similar publications. For operation on the 160, 75 and 40 meter bands, a simple dipole antenna, cut to resonance in the most used portion of the band, will perform saticfactorily. For operation on the 10, 15 and 20 meter bands, the efficiency of the station will be greatly increased if a good directional rotary antenna is used. Remember that even the most sophisticated transceiver is useless without a good antenna.

CAUTION:

Protect your Equipment – Use a LIGHTNING ARRESTOR.

1-6. GROUNDING

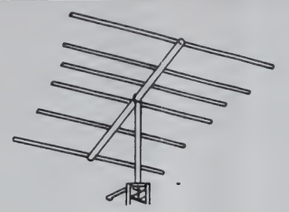
Making a good earth connection is important for preventing dangers such as electric shock and for emitting a high quality signal with minimum spurious radiation. Bury a commercially available ground rod or copper plate under the ground and connect it to the GND terminal of the TS-940S. A thick wire, cut as short as possible, should be used for the connection.

A city water pipe cannot be used as a good earth in some cases. To make a good earth connection, connect the GND terminal to a metal water pipe grounded.

Never use a gas pipe or electrical conduit pipe.

NOTE:

A ground connection that is a 1/4 wavelength or its multiple may provide a good DC ground, but it will not provide a good RF ground.



Beam antenna

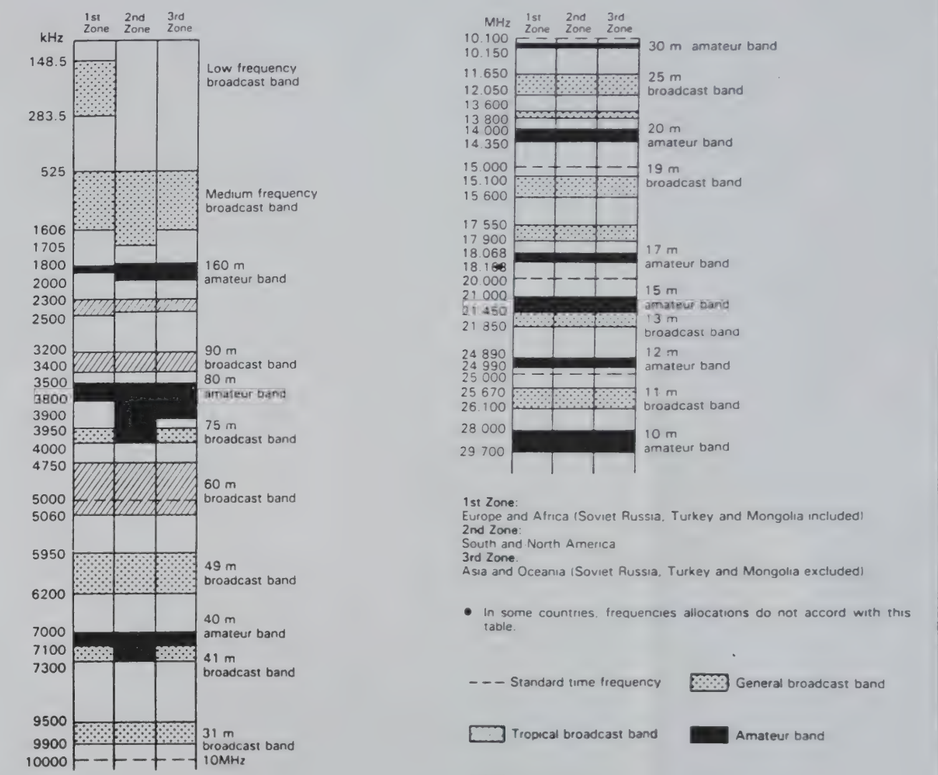
Ground plane antenna

Dipole antenna

OK

GAS

1-7. SHORT WAVE RECEPTION



Radio Frequency Allocation

Frequency Distribution in the Broadcast and Amateur Bands.

The TS-940S receiver covers from 150 kHz to 30 MHz, to receive international broadcast and communication services.

As shown in the Frequency Allocation Chart, above figure, broadcast and Amateur radio station frequencies are allocated in specific bands expressed in megahertz (MHz) or wavelength in meters (m). Also in the above figure the frequencies of "other stations" are assigned for fixed station business use, marine mobile, aviation mobile, land mobile, radio beacon stations, etc.

NOTE:

1. Radio stations throughout the world are listed in the WORLD RADIO TV HANDBOOK or similar publications.
2. Antennas designed for HAM BAND operation will generally provide satisfactory reception for SW stations near the HAM BANDS. For antenna construction details, see the ARRL ANTENNA HANDBOOK, or similar publications.

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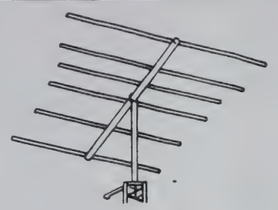
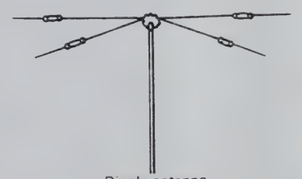


Beam antenna

Ground plane antenna

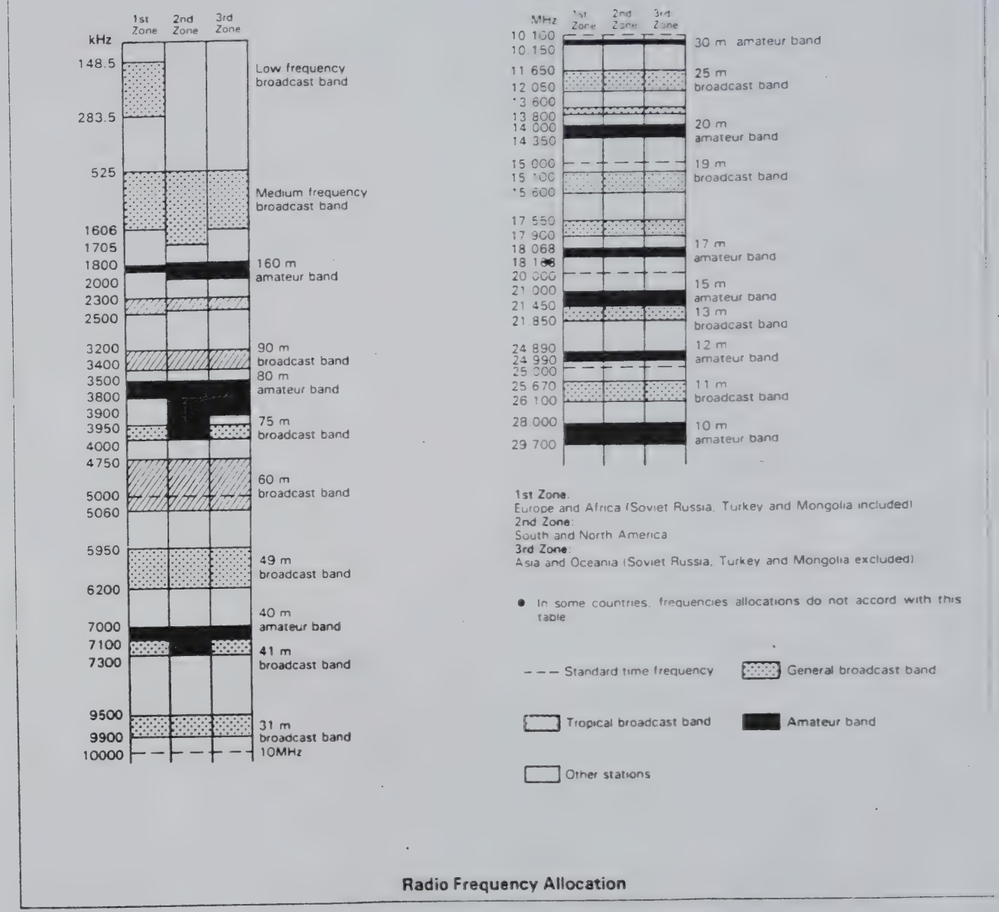


Dipole antenna

OK

GAS

1-7. SHORT WAVE RECEPTION



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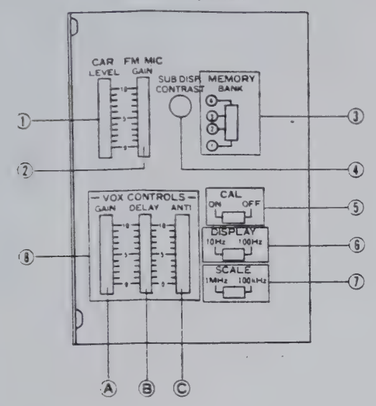
2. CONTROLS, INDICATORS AND CONNECTORS

TOP COVER

Slide lid opened



① **CAR LEVEL (carrier level) control**
Used to adjust carrier level during CW.

② **FM MIC GAIN (microphone gain) control**
Used to adjust microphone amplifier gain in FM.

③ **Memory group selector switch**
Allows to selection of the desired memory channel group.

④ **SUB DISP. CONTRAST control**
Allows you to adjust the contrast of the sub display, using a (–) screwdriver.

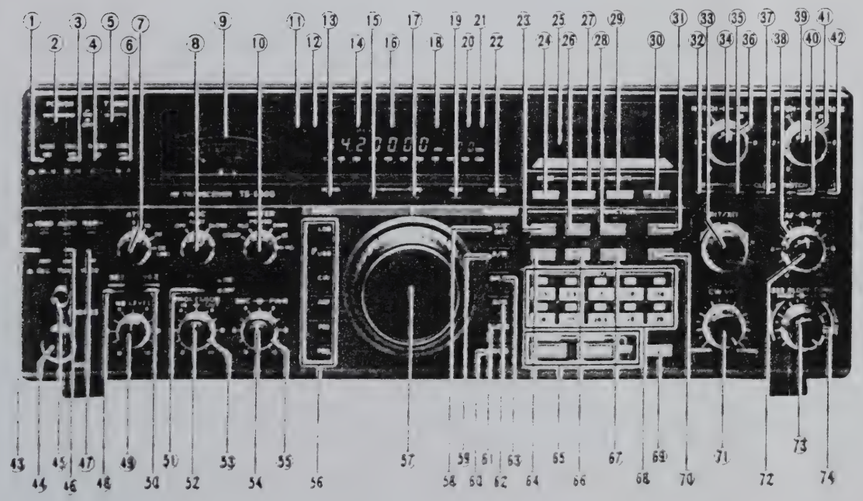
⑤ **CAL (marker) switch**
When this switch is ON during reception, the built-in oscillator will generate a marker signal at 100 kHz intervals. This switch is also used to zero beat the internal oscillator frequency with a standard frequency (WWV).

⑥ **10 Hz indication switch**
Allows frequency indication down to the nearest 10 Hz digit.

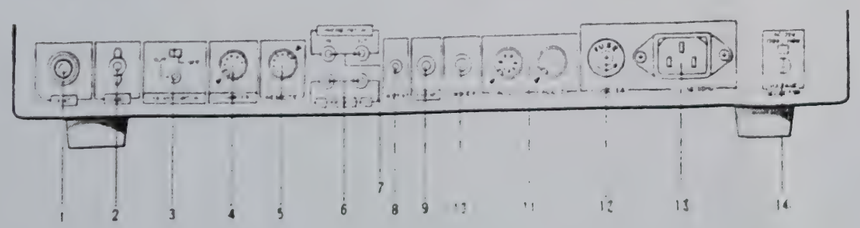
⑦ **Analog SCALE selection switch**
Used to select the analog scale range, 1 MHz or 100 kHz.

⑧ **VOX control**
Ⓐ GAIN: Used to adjust VOX amplifier gain.
Ⓑ DELAY: Used to adjust delay time.
Ⓒ ANTI: Used so that VOX will not be actuated by the internal speaker sound.

FRONT PANEL



REAR PANEL



FRONT PANEL

① **VOX switch** ⇨ page 24
② **POWER switch**
③ **CW break-in selector switch** ⇨ page 23
④ **MONI (monitor) switch** ⇨ pages 8,10, 14, 16
⑤ **TIMER switch** ⇨ page 38
⑥ **DIM (Dimmer) switch** ⇨ page 19
⑦ **ATT switch** ⇨ page 24
⑧ **AGC switch** ⇨ page 25
⑨ **Meter** ⇨ page 20
⑩ **METER switch** ⇨ page 20
⑪ **Main display**
⑫ **F. LOCK indicator** ⇨ page 19
⑬ **ON AIR indicator** ⇨ page 19
⑭ **VFO A indicator** ⇨ page 19
⑮, ⑰ **ANT TUNE indicator** ⇨ page 19
⑯ **VFO B indicator** ⇨ page 19
⑱ **MEMO (Memory) channel indicator** ⇨ page 19
⑲ **SPLIT indicator** ⇨ page 19
⑳ **RIT indicator** ⇨ page 19
㉑ **XIT indicator** ⇨ page 19
㉒ **NOTCH indicator** ⇨ page 19
㉓ **MS (Memory scan) switch** ⇨ page 33
㉔ **CLOCK switch** ⇨ page 35
㉕ **Sub-display** ⇨ page 35
㉖ **PG. S (Program scan) switch** ⇨ page 33
㉗ **GRAPH switch** ⇨ pages 35, 36
㉘ **HOLD switch** ⇨ page 33
㉙ **SCROLL switch** ⇨ pages 34, 35
㉚ **SET switch** ⇨ page 35
㉛ **M. CE switch** ⇨ page 34
㉜ **RIT switch** ⇨ page 26
㉝ **RIT/XIT control** ⇨ page 26
㉞ **NOTCH control** ⇨ page 22
㉟ **XIT switch** ⇨ page 26
㊱ **SQL control** ⇨ pages 9, 13, 15, 17
㊲ **CLEAR switch** ⇨ page 26
㊳ **RF (gain) control** ⇨ page 25
㊴ **PITCH control** ⇨ page 26
㊵ **NOTCH switch** ⇨ page 22
㊶ **AF TUNE control** ⇨ page 26
㊷ **AF TUNE switch** ⇨ page 26
㊸ **REC/SEND stand-by switch** ⇨ pages 9, 11, 15, 17
㊹ **MIC (Microphone) connector** ⇨ pages 7, 29
㊺ **PHONES jack** ⇨ pages 7, 29
㊻ **AUTO-THRU selector switch** ⇨ page 18
㊼ **NAR/WIDE switch** ⇨ pages 10, 12
㊽ **NB 1 switch** ⇨ page 22
㊾ **NB control** ⇨ page 22
㊿ **NB 2 switch** ⇨ page 22
(51) **PROC switch** ⇨ page 24
(52) **PROCESSOR-IN control** ⇨ page 24
(53) **PROCESSOR-OUT control** ⇨ page 24
(54) **MIC (microphone gain) control** ⇨ pages 9, 15
(55) **PWR (RF power) control** ⇨ pages 8, 10, 14, 16
(56) **MODE switch** ⇨ pages 8 ~ 17
(57) **Main tuning control** ⇨ pages 8 ~ 17
(58) **T-F SET switch** ⇨ page 20
(59) **A/B switch** ⇨ page 19
(60) **VOICE switch** ⇨ page 19
(61) **F. LOCK switch** ⇨ page 19
(62) **A = B switch** ⇨ page 19
(63) **SPLIT switch** ⇨ page 19
(64) **VFO/M switch** ⇨ page 31
(65) **1 MHz step switch** ⇨ pages 8 ~ 17
(66) **M ▶ VFO switch** ⇨ page 33
(67) **M. IN switch** ⇨ page 31
(68) **BAND KEY (1 – 10) switch** ⇨ pages 8 ~ 17
(69) **AT. T switch** ⇨ page 18
(70) **ENT (Enter) switch** ⇨ page 34
(71) **VBT control** ⇨ page 21
(72) **AF (audio gain) control** ⇨ page 26
(73) **SSB SLOPE TUNE HIGH CUT control** ⇨ page 21
(74) **SSB SLOPE TUNE LOW CUT control** ⇨ page 21

REAR PANNEL

① **Antenna connector**
Connect an antenna with an impedance of 50 Ω, with an SWR of 1.5 or less.

② **GND (ground) terminal**
Used to make TS-940S ground. Connect using as thick and short a wire as possible.

③ **RX ANT terminal selector switch**
Used to disconnect the TS-940S receiver. Supplies an antenna connection to an external receiver.

④ **Transverter connector**
For details, see page 29.

⑤ **Remote connector**
This connector is used when a linear amplifier is used.

⑥ **IF OUT jack**
IF 1 is for connection to the SM-220 for Pan Display. (8.83 MHz)
IF 2 is for connection to the SM-220 for RX Modulation Display. (100 kHz)

⑦ **PHONE PATCH jacks**
The IN terminal is used for transmit audio from the phone patch (600 Ω).
The OUT terminal is used for received audio from the transceiver to the phone patch (600 Ω). These jacks can also be used for input to and from SSTV, or RTTY terminals.

⑧ **RTTY jack**
For connection to an RTTY interface unit. (direct keying)

⑨ **EXT SP (external speaker)**
This terminal is for an external speaker.

⑩ **CW KEY jack**
Used to connect the key during use of CW

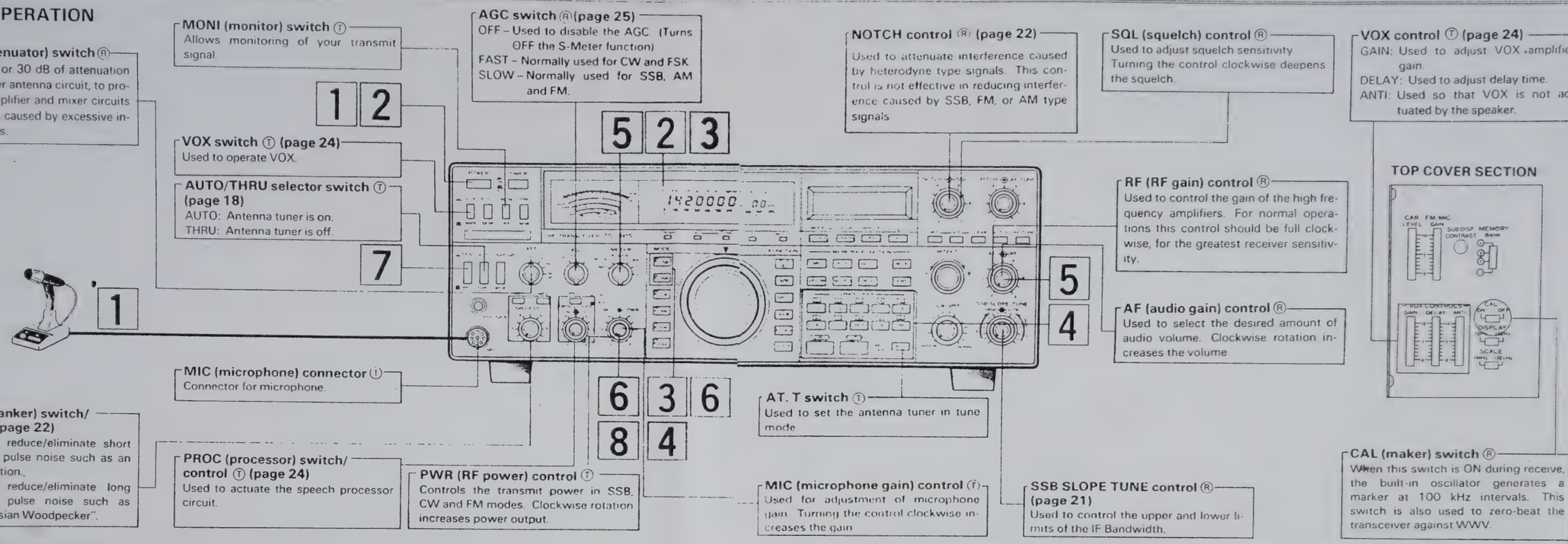
⑪ **Accessory terminals**

⑫ **Fuse Holder**

⑬ **AC power connector**
Connect the supplied power cord.

⑭ **VOLTAGE SELECTOR switch**
Used to select the correct line voltage.

3-3 SSB OPERATION


ATT (RF attenuator) switch Ⓡ
Inserts 10, 20 or 30 dB of attenuation into the receiver antenna circuit, to protect the RF amplifier and mixer circuits from distortion caused by excessive input signal levels.
MONI (monitor) switch Ⓣ
Allows monitoring of your transmit signal.
1 2
VOX switch Ⓣ (page 24)
Used to operate VOX.
AUTO/THRU selector switch Ⓣ (page 18)
AUTO: Antenna tuner is on.
THRU: Antenna tuner is off.
7
1
MIC (microphone) connector Ⓘ
Connector for microphone.
NB (noise blanker) switch/ control Ⓡ (page 22)
NB1: Used to reduce/eliminate short duration pulse noise such as an auto ignition.
NB2: Use to reduce/eliminate long duration pulse noise such as the "Russian Woodpecker".
PROC (processor) switch/ control Ⓣ (page 24)
Used to actuate the speech processor circuit.
PWR (RF power) control Ⓣ
Controls the transmit power in SSB, CW and FM modes. Clockwise rotation increases power output.
AGC switch Ⓡ (page 25)
OFF – Used to disable the AGC (Turns OFF the S-Meter function)
FAST – Normally used for CW and FSK
SLOW – Normally used for SSB, AM and FM.
5 2 3
6 3 6
8 4
AT. T switch Ⓣ
Used to set the antenna tuner in tune mode
MIC (microphone gain) control Ⓣ
Used for adjustment of microphone gain. Turning the control clockwise increases the gain
NOTCH control Ⓡ (page 22)
Used to attenuate interference caused by heterodyne type signals. This control is not effective in reducing interference caused by SSB, FM, or AM type signals
SQL (squelch) control Ⓡ
Used to adjust squelch sensitivity
Turning the control clockwise deepens the squelch.
RF (RF gain) control Ⓡ
Used to control the gain of the high frequency amplifiers. For normal operations this control should be full clockwise, for the greatest receiver sensitivity.
AF (audio gain) control Ⓡ
Used to select the desired amount of audio volume. Clockwise rotation increases the volume
5
4
SSB SLOPE TUNE control Ⓡ (page 21)
Used to control the upper and lower limits of the IF Bandwidth.
VOX control Ⓣ (page 24)
GAIN: Used to adjust VOX amplifier gain.
DELAY: Used to adjust delay time.
ANTI: Used so that VOX is not actuated by the speaker.
TOP COVER SECTION
CAL (maker) switch Ⓡ
When this switch is ON during receive, the built-in oscillator generates a marker at 100 kHz intervals. This switch is also used to zero-beat the transceiver against WWV.

RECEIVE

1. Turn on the power.
2. The meter lamp lights and a frequency is shown on the display.
3. For operation up to the 7 MHz band, place the MODE switch to LSB. For operation on or above the 10 MHz band, use the USB mode.

Note:
Ⓣ denotes transmit operation.
Ⓡ denotes receive operation.

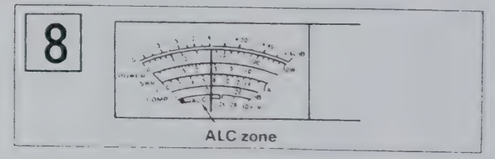
4. Select the desired band by operating the BAND/ KEY switch or with the 1 MHz step switch.
5. Adjust audio volume with the AF (audio gain) control
6. Adjust the main tuning control so that the desired signal may be clearly heard.

TRANSMISSION

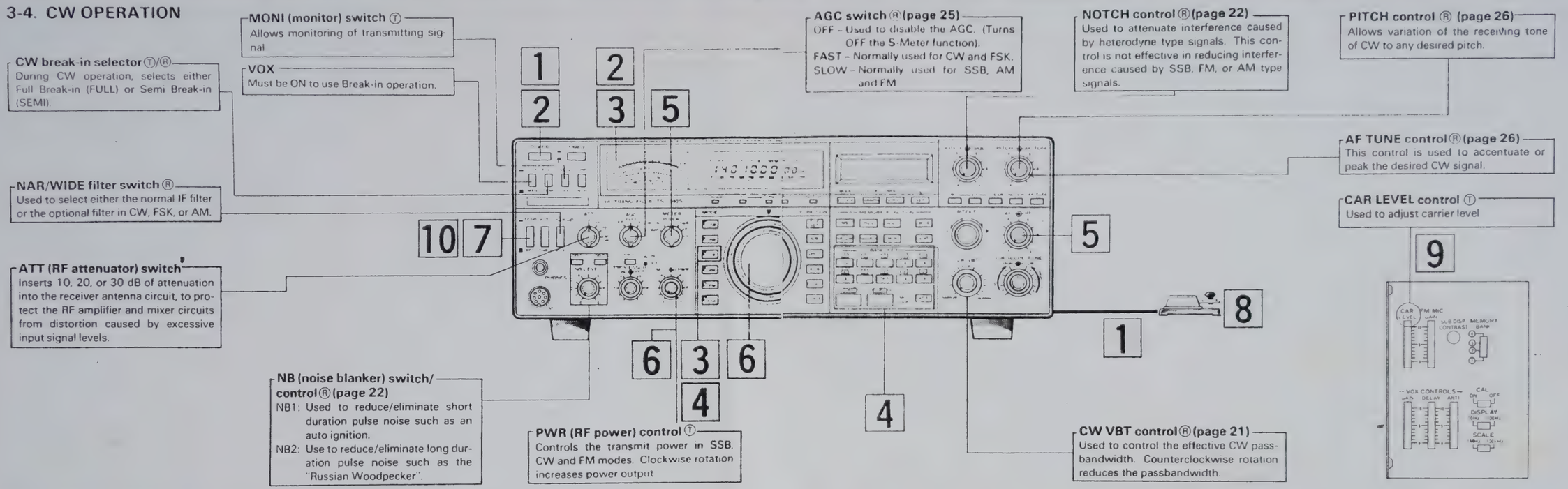
1. Connect themicrophone.
2. Turn on the power.
3. The meter lamp lights and a frequency is shown on the display.
4. For operation up to the 7 MHz band, place the MODE switch to LSB. For operation on or above the 10 MHz band, use the USB mode.
5. Set the METER switch to ALC.
6. Turn the PWR control fully clockwise.
7. Press the miocrophone PTT switch or move the standby switch from REC to SEND.
8. Speak into the microphone and adjust the MIC gain control so that the meter deflection does not exceed the ALC zone at voice peaks.

Local Operations

This transceiver is equipped with an RF power control to vary transmit power output. Turning the PWR control counterclockwise reduces the transmit power output. Use of this control will help to reduce interference on the bands.



3-4. CW OPERATION


MONI (monitor) switch Ⓣ
Allows monitoring of transmitting signal
CW break-in selector Ⓣ/Ⓡ
During CW operation, selects either Full Break-in (FULL) or Semi Break-in (SEMI).
VOX
Must be ON to use Break-in operation.
AGC switch Ⓡ (page 25)
OFF – Used to disable the AGC. (Turns OFF the S-Meter function).
FAST – Normally used for CW and FSK.
SLOW – Normally used for SSB, AM and FM
NOTCH control Ⓡ (page 22)
Used to attenuate interference caused by heterodyne type signals. This control is not effective in reducing interference caused by SSB, FM, or AM type signals.
PITCH control Ⓡ (page 26)
Allows variation of the receiving tone of CW to any desired pitch.
AF TUNE control Ⓡ (page 26)
This control is used to accentuate or peak the desired CW signal.
CAR LEVEL control Ⓣ
Used to adjust carrier level
NAR/WIDE filter switch Ⓡ
Used to select either the normal IF filter or the optional filter in CW, FSK, or AM.
ATT (RF attenuator) switch
Inserts 10, 20, or 30 dB of attenuation into the receiver antenna circuit, to protect the RF amplifier and mixer circuits from distortion caused by excessive input signal levels.
NB (noise blanker) switch/control Ⓡ (page 22)
NB1: Used to reduce/eliminate short duration pulse noise such as an auto ignition.
NB2: Use to reduce/eliminate long duration pulse noise such as the "Russian Woodpecker".
PWR (RF power) control Ⓣ
Controls the transmit power in SSB, CW and FM modes. Clockwise rotation increases power output
CW VBT control Ⓡ (page 21)
Used to control the effective CW passbandwidth. Counterclockwise rotation reduces the passbandwidth.
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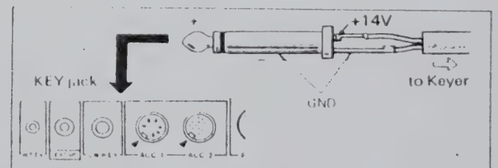
RECEPTION

1. Turn on the power.
2. The meter lamp lights and a frequency is shown on the display.
3. Set the MODE to FM.
4. Select the desired band by operating the BAND/KEY switch or with the 1 MHz step switch.
5. Adjust audio volume with the AF (audio gain) control.
6. Adjust the main tuning control so that the desired signal can be clearly heard.

TRANSMISSION

1. Using shielded line, connect a key or keyer to the CW KEY jack on the rear panel.



Key plug connection

Caution:
When using an electric keyer, check the polarity of the key jack is as shown.

2. Turn on the power.
3. The meter lamp lights and a frequency is shown on the display.
4. Set the MODE to CW.
5. Set the METER switch to ALC.
6. Turn the PWR control fully clockwise.
7. Set the standby switch to SEND, if you are not using Semi-Break in
8. Depress the key.

Note:
With the VOX switch ON, pressing the key down permits transmission even with the standby switch set to REC. This is called Semi-break-in operation. (See page 23)

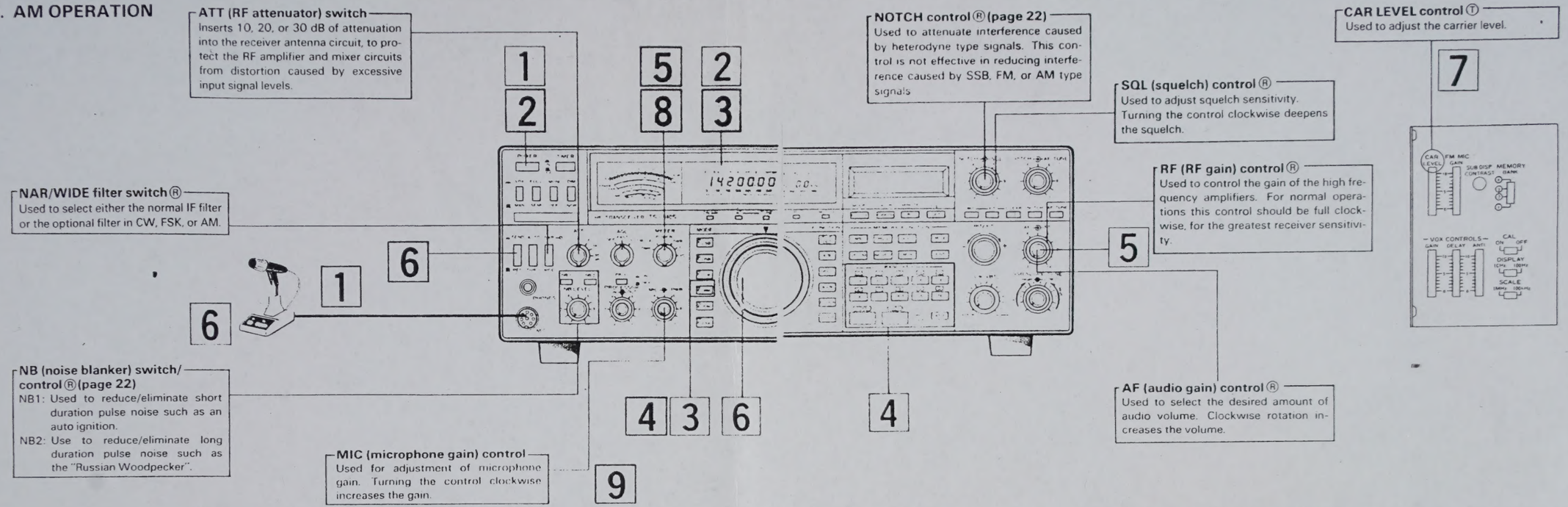
9. Adjust the CAR LEVEL control on the top cover so that the meter deflection is within the ALC zone.

ALC zone

10. After transmission set the standby switch to REC.

Note:
The frequency display shows the transmit carrier frequency.

3-5. AM OPERATION


ATT (RF attenuator) switch
Inserts 10, 20, or 30 dB of attenuation into the receiver antenna circuit, to protect the RF amplifier and mixer circuits from distortion caused by excessive input signal levels.
NOTCH control Ⓡ (page 22)
Used to attenuate interference caused by heterodyne type signals. This control is not effective in reducing interference caused by SSB, FM, or AM type signals.
CAR LEVEL control Ⓣ
Used to adjust the carrier level.
SQL (squelch) control Ⓡ
Used to adjust squelch sensitivity. Turning the control clockwise deepens the squelch.
NAR/WIDE filter switch Ⓡ
Used to select either the normal IF filter or the optional filter in CW, FSK, or AM.
RF (RF gain) control Ⓡ
Used to control the gain of the high frequency amplifiers. For normal operations this control should be full clockwise, for the greatest receiver sensitivity.
NB (noise blanker) switch/control Ⓡ (page 22)
NB1: Used to reduce/eliminate short duration pulse noise such as an auto ignition.
NB2: Use to reduce/eliminate long duration pulse noise such as the "Russian Woodpecker".
MIC (microphone gain) control
Used for adjustment of microphone gain. Turning the control clockwise increases the gain.
AF (audio gain) control Ⓡ
Used to select the desired amount of audio volume. Clockwise rotation increases the volume.
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RECEPTION

1. Turn on the power.
2. The meter lamp lights and a frequency is shown on the display.
3. Set the MODE switch to AM.
4. Select the desired band by operating the BAND/KEY switch or with the 1 MHz step switch.
5. Adjust audio volume with the AF (audio gain) control
6. Adjust the main tuning control so that the desired signal can be clearly heard.

Note:
If you are receiving a weak DX station or are experiencing some interference, try setting the NAR/WIDE switch to NAR. This reduces the bandwidth and may help reduce or eliminate the interference.

TRANSMISSION

1. Connect a microphone.
2. Turn on the power.
3. The meter lamp lights and a frequency is shown on the display.
4. Set the MODE to AM.
5. Place the METER switch to POWER.
6. Press the miocrophone PTT switch or move the standby switch from REC to SEND.
7. Adjust the CAR LEVEL control on the top cover for 50W.
8. Place the METER switch to ALC.
9. Speak into the microphone and adjust the MIC gain control so the meter deflection becomes minimum at voice peaks.

Note:
If the protection circuit is activated due to poor antenna VSWR, turning the RF PWR control to the maximum, may not provide a 100W meter reading. Therefore check the antenna VSWR. If it is poor, correct before transmitting again.

3-6. FM OPERATION

ATT (RF attenuator) switch
Inserts 10, 20, or 30 dB of attenuation into the receiver antenna circuit, to protect the RF amplifier and mixer circuits from distortion caused by excessive input signal levels.

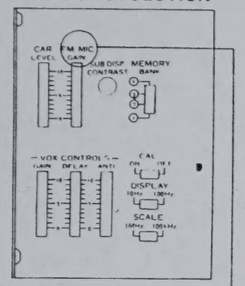
MONI (monitor) switch Ⓡ
Allows monitoring of your transmitting signal.

SQL (squelch) control Ⓡ
Used to adjust squelch sensitivity. Turning the control clockwise deepens the squelch.

RF (RF gain) control Ⓡ
Used to control the gain of the high frequency amplifiers. For normal operations this control should be full clockwise, for the greatest receiver sensitivity.

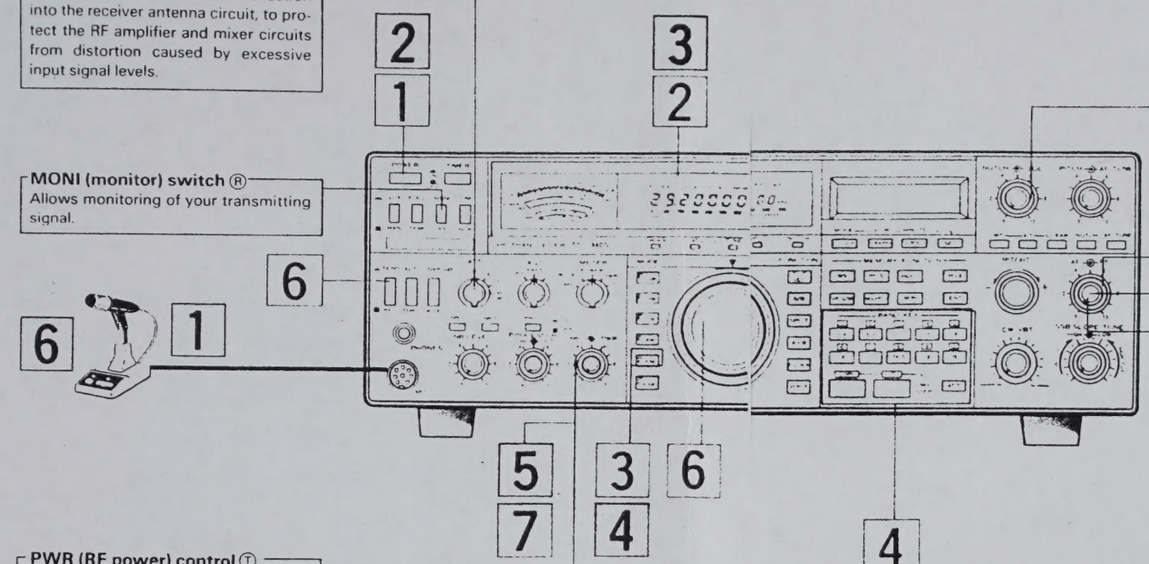
AF (audio gain) control Ⓡ
Used to select the desired amount of audio volume. Clockwise rotation increases the volume.

TOP COVER SECTION



FM MIC GAIN (microphone gain) control Ⓣ
Used to adjust microphone amplifier gain.

PWR (RF power) control Ⓣ
Controls the transmit power in SSB, CW and FM modes. Clockwise rotation increases power output.

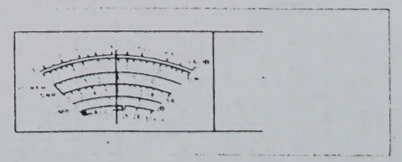


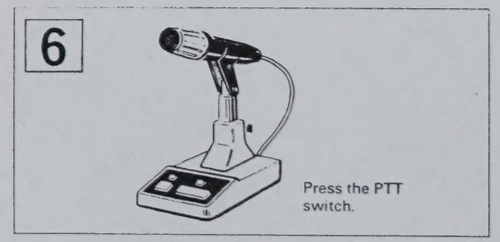
RECEPTION

1. Turn on the power.
2. The meter lamp lights and a frequency is shown on the display.
3. Set the MODE to CW.
4. Select the desired band by operating the BAND/KEY switch or with the 1 MHz step switch.
5. Adjust audio volume with the AF (audio gain) control.
6. Adjust the main tuning control so that the desired signal may be clearly heard.

TRANSMISSION

1. Connect the microphone.
2. Turn on the power.
3. The meter lamp lights up.
4. Set the MODE to FM.
5. Turn the PWR control fully clockwise.
6. Press the microphone PTT switch or place the standby switch to SEND.
7. Adjust the PWR control so that the meter deflection is within the ALC zone.





Local Operation
This transceiver is equipped with an RF power control to vary transmit power output. Turning the PWR control counterclockwise reduces the transmit power output.

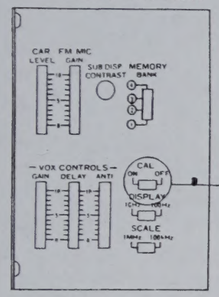
3-7. FSK (RTTY) OPERATION

MONI (monitor) switch Ⓣ
Allows monitoring of your transmitting signal.

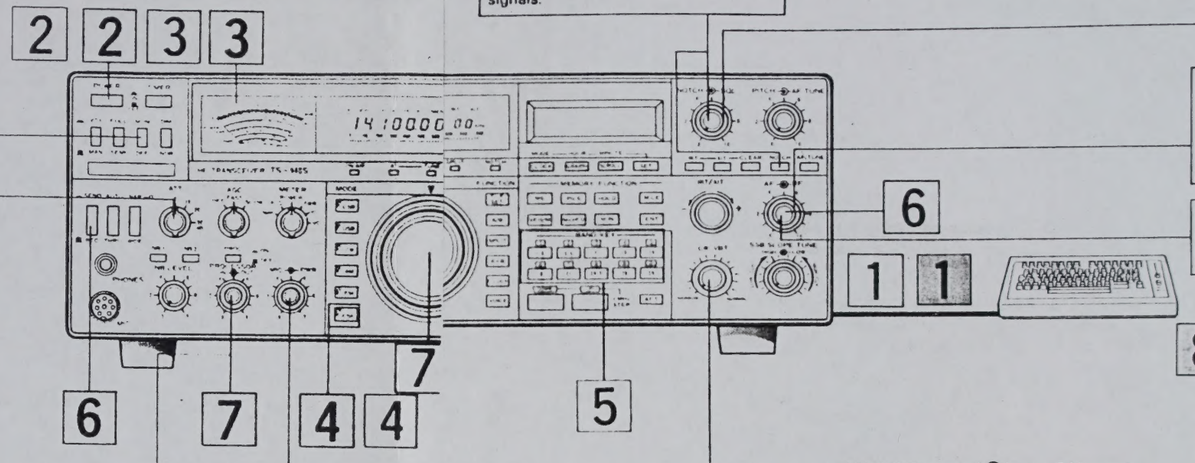
NOTCH control Ⓡ (page 22)
Used to attenuate interference caused by heterodyne type signals. This control is not effective in reducing interference caused by SSB, FM, or AM type signals.

SQL (squelch) control Ⓡ
Used to adjust squelch sensitivity. Turning the control clockwise deepens the squelch.

TOP COVER SECTION



ATT (RF attenuator) switch
Inserts 10, 20, or 30 dB of attenuation into the receiver antenna circuit, to protect the RF amplifier and mixer circuits from distortion caused by excessive input signal levels.



RF (RF gain) control Ⓡ
Used to control the gain of the high frequency amplifiers. For normal operations this control should be full clockwise, for the greatest receiver sensitivity.

AF (audio gain) control Ⓡ
Used to select the desired amount of audio volume. Clockwise rotation increases the volume.

CAL (marker) switch Ⓡ
When this switch is ON during receive, the built-in oscillator generates a marker at 100 KHz intervals. This switch is also used to zero-beat the transceiver against WWV.

PROC (processor) switch/control
⇨ **page 24**
OUT: Controls the output level.

PWR (RF power) control Ⓣ
Controls the transmit power in SSB, CW and FM modes. Clockwise rotation increases power output

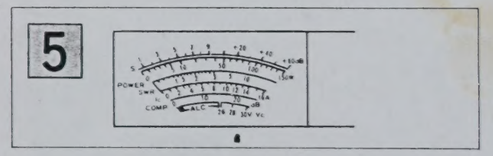
CW VBT control Ⓡ (page 21)
Used to control the effective CW passbandwidth. Counterclockwise rotation reduces the passbandwidth.

RECEPTION

1. Connect the RTTY terminal to the RTTY jack.
2. Turn on the power.
3. The meter lamp lights and a frequency is shown on the display.
4. Set the MODE to FSK.
5. Select the desired band by operating the BAND/KEY (1 – 0) switch or with the 1 MHz step switch.
6. Adjust the AF (audio gain) control.
7. Adjust the main tuning control so that the desired signal is correctly demodulated.

TRANSMISSION

1. Connect the RTTY keyboard to the RTTY jack on the rear panel.
2. Turn on the power.
3. The meter lamp lights and a frequency is shown on the display.
4. Set the MODE to FSK.
5. Set the METER switch to ALC.
6. Set the standby switch to SEND.
7. Adjust the PROCESSOR-OUT control so that the meter deflection is within the ALC zone.
8. Operate the RTTY keyboard.

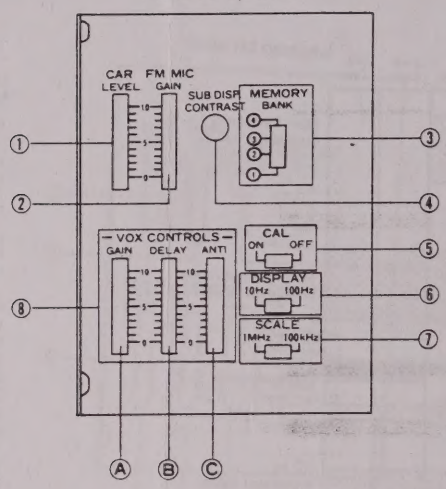


CAUTION:
The TS-940S may be operated at full power for no more than 1 hour with the transmitter keyed continuously. If transmissions longer than one hour are necessary, use the RF POWER control to reduce the output level of the TS-940S to 50 watts or less.

2. CONTROLS, INDICATORS AND CONNECTORS

TOP COVER

Slide lid opened



① **CAR LEVEL (carrier level) control**
Used to adjust carrier level during CW.

② **FM MIC GAIN (microphone gain) co**
Used to adjust microphone amplifier ga

③ **Memory group selector switch**
Allows to selection of the desired m
group.

④ **SUB DISP. CONTRAST control**
Allows you to adjust the contrast of th
ing a (–) screwdriver.

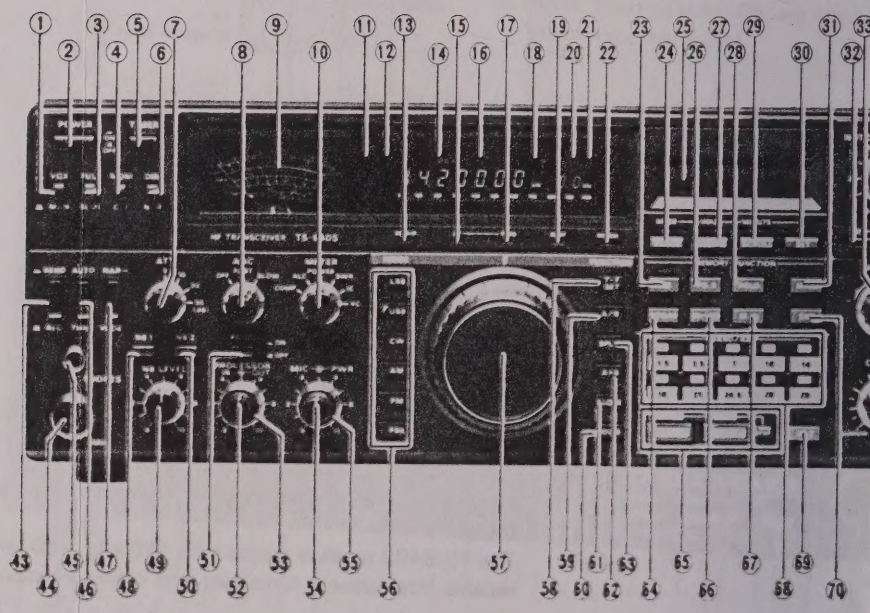
⑤ **CAL (marker) switch**
When this switch is ON during
built-in oscillator will generate a mark
kHz intervals. This switch is also used
internal oscillator frequency with a
quency (WWV).

⑥ **10 Hz indication switch**
Allows frequency indication down to th
digit.

⑦ **Analog SCALE selection switch**
Used to select the analog scale ra
100 kHz.

⑧ **VOX control**
Ⓐ GAIN: Used to adjust VOX amplifier
Ⓑ DELAY: Used to adjust delay time.
Ⓒ ANTI: Used so that VOX will not be
internal speaker sound.

FRONT PANEL



REAR PANEL